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(4) Twenty-eight thousand nine hundred and fifty-nine. Eight thousand and ninety-nine. Eighty thousand six hundred and nine. Three hundred and fifty-four thousand six hundred and fifty-four. Eight hundred and eighty. Eighty thousand eight hundred.

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3087469125	4322456775	4939950600
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(5)

709538642	709538642	709538642
26	39	58
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Ans. 18448004692;	27672007038;	41153241236.

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365
236298190
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29608174
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236865392
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19508469
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175576221
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12
233*d.* *Ans.*

(7) 12*s.* $10\frac{3}{4}$*d.*
12
$154\frac{3}{4}$*d.*
4
619*f.* *Ans.*

37*s.* $9\frac{1}{2}$*d.*
12
$453\frac{1}{2}$*d.*
4
1814*f.* *Ans.*

£9 10*s.* 1*d.*
20
190*s.*
12
2281*d.*
4
9124*f.* *Ans.*

(8) 359 13*s.* $6\frac{1}{4}$*d.*
20
7193*s.*
12
86322*d.*
4
345289*f.* *Ans.*

£3000 10*s.*
20
60010*s.*
12
720120*d.*
4
2880480*f.* *Ans.*

(9) £89 18*s.* $11\frac{1}{2}$*d.*
20
1798*s.*
12
21587*d.*
2
43175 *hf. d.* *Ans.*

£57 0*s.* 5*d.*
20
1140*s.*
12
13685*d.*
2
27370 *hf. d.* *Ans.*

(10) 2) 9753 *hf. d.*
12) $4876\frac{1}{2}$*d.*
2,0) 40,6*s.* $4\frac{1}{2}$*d.*
£20 6*s.* $4\frac{1}{2}$*d.* *Ans.*

2) 176401 *hf. d.*
12) $88200\frac{1}{2}$*d.*
2,0) 735,0*s.* $0\frac{1}{2}$*d.*
£367 10*s.* $0\frac{1}{2}$*d.* *Ans.*

(11) 450 *guin.*
21
9450*s.*
12
113400*d.* *Ans.*

42*s.* $10\frac{1}{2}$*d.*
12
$514\frac{1}{2}$*d.* *Ans.*

(12) 21) 4557*s.*
Guin. 217. *Ans.*

12) 9828*d.*
21) 819*s.*
Guin. 39. *Ans.*

(13) £26 16*s.*
20
536*s.*
3
1608 *fo. Ans.*

£78 13*s.* 8*d.*
20
1573*s.*
3
4721 *fo. Ans.*

(14) 169*s.*
4
676 *thr. Ans.*

£85
20
1700*s.*
4
6800 *thr. Ans.*

4) 1352*f.*
3) 338*d.*
112 *thr.* 2*d. Ans.*

(15) £56 8*s.* 6*d.*
20
1128*s.*
2
2257 *sixp. Ans.*

4) 1753*f.*
6) 438¼*d.*
73 *sixp.* 0¼*d. Ans.*

(16) 2) 15330 *sixp.*
21) 7665*s.*
Guin. 365. *Ans.*

3) 25767 *fourp.*
21) 8589*s.*
Guin. 409. *Ans.*

(17) 2739 *hf. sovs.*
10
27390*s.*
12
328680*d. Ans.*

519 *hf. crs.*
30
15570*d. Ans.*

(18) 3) 5942 *fourp.*
5) 1980*s.* 8*d.*
396 *crs.* 8*d. Ans.*

4) 1009 *threep.*
5) 252*s.* 3*d.*
50 *crs.* 2*s.* 3*d. Ans.*

(19) 4) 31175*f.*
3,0) 779,3¾*d.*
259 *hf. crs.* 1*s.* 11¼*d. Ans.*

£39 7*s.* 6*d.*
8
315 *hf. crs. Ans.*

£46 10*s.*
8
372 *hf. crs. Ans.*

(20) 12) 1789*d.*
2) 149*s.* 1*d.*
74*fl.* 1*s.* 1*d.* *Ans.*

8) 742 *threep.*
92 *fl.* 1*s.* 6*d.* *Ans.*

£311 14*s.*
10
3117*fl.* *Ans.*

(21) 24) 62252 grs.
2,0) 259,3 dwt. 20 grs.
12) 129 oz. 13 dwt.
10 lbs. 9 oz. 13 dwt. 20 grs. *Ans.*

24) 19696 grs.
2,0) 82,0 dwt. 16 grs.
12) 41 oz.
3 lbs. 5 oz. 16 grs. *Ans.*

(22) 25 lbs. 10 oz. 17 dwt.
12
310 oz.
20
6217 dwt.
24
149208 grs. *Ans.*

11 lbs. 12 dwt. 21 grs.
12
132 oz.
20
2652 dwt.
24
63669 grs. *Ans.*

(23) 11 oz. 20 grs.
20
220 dwt.
24
5300 grs. *Ans.*

213 lbs. 19 grs.
12
2556 oz.
20
51120 dwt.
24
1226899 grs. *Ans.*

14 lbs. 14 dwt.
12
168 oz.
20
3374 dwt.
24
80976 grs. *Ans.*

(24) 2,0) 537,5 dwt.
12) 268 oz. 15 dwt.
22 lbs. 4 oz. 15 dwt. *Ans.*

2) 1364 hf. oz.
12) 682 oz.
56 lbs. 10 oz. *Ans.*

2,0) 457,9 dwt.
12) 228 oz. 19 dwt.
19 lbs. 19 dwt. *Ans.*

(25) 63 cwt. 3 qrs. 25 lbs.
4
255 qrs.
28
7165 lbs. *Ans.*

14 t. 14 cwt.
20
294 cwt.
112
32928 lbs. *Ans.*

13 cwt. 8 oz.
112
1456½ lbs. *Ans.*

(26) 28) 1974 lbs. 16) 65020 oz.
4) 70 qrs. 14 lbs. 28) 4063 lbs. 12 oz.
17 cwt. 2 qrs. 14 lbs. *Ans.* 4) 145 qrs. 3 lbs.
36 cwt. 1 qr. 3 lbs. 12 oz. *Ans.*

(27) 49 cwt. 2 qrs. 8 cwt. 1 qr. 27 lbs. 7 oz.
4 4
198 qrs. 33 qrs. 3 qrs. 13 lbs.
28 28 28
5544 lbs. 951 lbs. 97 lbs.
16 16 16
88704 oz. *Ans.* 15223 oz. *Ans.* 1552 oz. *Ans.*

(28) 3 t. 13 cwt. 13 oz. 2 t. 7 cwt. 3 qrs. 15 lbs.
20 20
73 cwt. 47 cwt.
112 4
8176 lbs. 191 qrs.
16 28
130829 oz. *Ans.* 5363 lbs. × 16 = 85808 oz. *Ans.*

(29) 4567 oz.
28) 14660 lbs. 7 oz. 28) 34567 lbs.
4) 523 qrs. 16 lbs. 4) 1234 qrs. 15 lbs.
2,0) 13,0 cwt. 3 qrs. 2,0) 30,8 cwt. 2 qrs.
6 t. 10 cwt. 3 qrs. 16 lbs. 7 oz. *Ans.* 15 t. 8 cwt. 2 qrs. 15 lbs. *Ans.*

(30) 16) 510713 drs. 16) 407365 oz.
16) 31919 oz. 9 drs. 28) 25460 lbs. 5 oz.
28) 1994 lbs. 15 oz. 4) 909 qrs. 8 lbs.
4) 71 qrs. 6 lbs. 227 cwt. 1 qr. 8 lbs. 5 oz. *Ans.*
17 cwt. 3 qrs. 6 lbs. 15 oz. 9 drs. *Ans.*

(31) 47 yds. 2 ft. 10 in. 6 fur. 106 yds. 1 ft.
3 220
143 ft. 1426 yds.
12 3
1726 in. *Ans.* 4279 ft. × 12 = 51348 in. *Ans.*

(32) 3 mi. 5 fur. 62 yds. 23 mi. 323 yds. 2 ft.
8 1760
29 fur. 40803 yds.
220 3
6442 yds. 122411 ft. *Ans.*
3
19326 ft. *Ans.*

12) 7635000 in.
3) 636250 ft.

(33) 220) 1040638 yds. 220) 212083 yds. 1 ft.
8) 4730 fur. 38 yds. 8) 964 fur. 3 yds.
591 mi. 2f. 38 yds. *Ans.* 120 mi. 4f. 3 yds. 1 ft. *Ans.*

(34) 3265 sq. yds. 7 ft. 750 cub. yds. 29 ft. 100 in.
9 27
29392 sq. ft. 20270 cub. ft.
144 1728
4232448 sq. in. *Ans.* 35026660 cub. in. *Ans.*

(35) 14 ac. 3 ro. 31 po. 263 ac. 2 ro. 7 ac. 17¼ po
4 4 4
59 ro. 1054 ro. 28 ro.
40 40 40
2391 po. *Ans.* 42160 po. *Ans.* 1137¼ po. *Ans.*

(36) 4,0) 13070,8 po. 275 sq. mi.
4) 3267 ro. 28 po. 640
816 ac. 3 ro. 28 po. *Ans.* 176000 ac. *Ans.*

(37) 478 gals. 47 gals. 3 qts. (38) 6 qu. 5 bu. 4) 112 pks.
8 4 8 28 bu. *Ans.*
3824 pts. *Ans.* 191 qts. 53 bu. *Ans.*
2
382 pts. *Ans.*

(39) 49 wks. 6 da. 19 hrs. 365 da. 6 hrs.
7 24
349 da. 8766 hrs.
24 60
8395 hrs. × 60 = 503700 min. *Ans.* 525960 min. *Ans.*

(40) $\frac{4 \text{ qrs.} \times 315}{5 \text{ qrs.}} = 4 \times 63 = 252$ Eng. ells. *Ans.*

$\frac{4 \text{ qrs.} \times 343\frac{3}{4}}{5 \text{ qrs.}} = \frac{1375}{5} = 275$ Eng. ells. *Ans.*

(41) $\frac{5 \text{ qrs.} \times 168}{4 \text{ qrs.}} = 5 \times 42 = 210$ yds. *Ans.*

209 ells. 4 qrs.
5
1049 qrs. of a yard ÷ 4 qrs. = 262 yds. 1 qr. *Ans.*

(42) $\frac{20s. \times 431}{21s.} = \frac{8620}{21} = 410$ *guin.* 10*s.* *Ans.*

£37 16*s.* × 20 = 756; 756 ÷ 21 = 36 *guin.* *Ans.*

£275 10*s.* × 20 = 5510*s.*; 5510*s.* ÷ 21 = 262 *guin.* 8*s.* *Ans.*

(43) $\frac{21s. \times 57}{20s.} = £59\ 17s.$ *Ans.* $\frac{21s. \times 180}{20s.} = 21 \times 9 = £189.$ *Ans.*

(44) 237 lbs. Tr. each 5760 grs. = 5760 grs. × 237, which ÷ 7000 grs. for each lb. Av. becomes = $144 \times 237 \div 175 = 195\frac{3}{175}$ lbs. Av. *Ans.*

1050 oz. Tr. = $\frac{1050}{12}$ lbs. Tr. each 5760 grs. = $\frac{5760 \text{ grs.} \times 1050}{12}$,

which ÷ 7000 grs. for each lb. Av. becomes = $\frac{144 \times 1050}{12 \times 175}$

$= 12 \times 6 = 72$ lbs. Av. *Ans.*

(45) 432 lbs. Av. each 7000 grs. = 7000 grs. × 432, which ÷ 5760 grs. for each lb. Tr. becomes = $175 \times 432 \div 144 = 175 \times 3$ $= 525$ lbs. Tr. *Ans.*

1175 oz. Av. = $\frac{1175}{16}$ lbs. Av. each 7000 grs. = $\frac{7000 \text{ grs.} \times 1175}{16}$,

which ÷ 5760 grs. for each lb. Tr. becomes = $\frac{175 \times 1175}{16 \times 144} =$

$89\frac{569}{2304}$ lbs. Tr. *Ans.*

COMPOUND ADDITION.

Answers to **Ex. 11.**

	£	s.	d.		£	s.	d.		£	s.	d.
(1)	32	14	8	(2)	269	15	10	(3)	360	2	$8\frac{3}{4}$
(4)	404	14	1	(5)	440	15	$6\frac{1}{4}$	(6)	428	3	$9\frac{1}{2}$
(7)	334	19	4	(8)	500	1	$2\frac{1}{4}$	(9)	356	9	$10\frac{3}{4}$
(10)	440	7	8	(11)	526	8	4	(12)	703	2	$10\frac{1}{4}$
(13)	15822	15	$4\frac{1}{2}$	(14)	14809	18	3	(15)	7860	19	0

	cwt.	qrs.	lbs.		lbs.	oz.	drs.		t.	cwt.	qr.	lbs.	oz.
(16)	179	2	18	(17)	201	11	12	(18)	192	12	1	4	3

	lbs.	oz.	dwt.		yds.	ft.	in.		mi.	f.	yds.	in.
(19)	140	7	8	(20)	208	1	6	(21)	242	3	120	11

	ac.	ro.	po.		sq. yds.	ft.	in.		c. yds.	ft.	in.
(22)	209	1	28	(23)	286	5	120	(24)	633	12	485

	gals.	qts.	pts.		qu.	bu.	pk.		da.	hrs.	min.	sec.
(25)	226	2	0	(26)	267	4	1	(27)	1060	13	41	26

	£	s.	d.		£	s.	d.		£	s.	d.
(28)	1325	2	$11\frac{1}{4}$	(29)	12067	18	5	(30)	3145	13	6

COMPOUND SUBTRACTION.

Answers to **Ex. 12.**

	£	s.	d.		£	s.	d.		£	s.	d.
(1)	5	8	$1\frac{1}{4}$	(2)	15	16	$10\frac{1}{2}$	(3)	48	8	5
(4)	49	19	$6\frac{3}{4}$	(5)	9	10	$11\frac{1}{2}$	(6)	48	10	3
(7)	30	19	$6\frac{1}{4}$	(8)	90	11	$11\frac{1}{2}$	(9)	109	16	$8\frac{3}{4}$
(10)	76	16	$1\frac{3}{4}$	(11)	70	0	$11\frac{1}{4}$	(12)	36	19	$7\frac{1}{4}$

	lbs.	oz.	dwt.		oz.	dwt.	grs.		cwt.	qr.	lbs.
(13)	25	10	15	(14)	10	3	23	(15)	15	1	19

	yds.	ft.	in.		ac.	ro.	po.	yds.		mi.	yds.	ft.
(16)	29	2	6	(17)	129	3	31	13	(18)	79	1468	1

	da.	hrs.	min.		£	s.	d.		£	s.	d.
(19)	286	15	49	(20)	99	19	$5\frac{1}{2}$	and	98	19	$11\frac{1}{2}$

	£	s.	d.		£	s.	d.
(21)	2091	1	9	(22)	17	18	5

COMPOUND MULTIPLICATION.

Ex. 13.

	£	s.	d.	£	s.	d.	£	s.	d.
(1) *Ans.*	92	17	$7\frac{1}{2}$;	139	6	$5\frac{1}{4}$;	185	15	3
(2) *Ans.*	285	19	$4\frac{1}{2}$;	381	5	10 ;	476	12	$3\frac{1}{2}$
(3) *Ans.*	175	13	$10\frac{1}{2}$;	527	1	$7\frac{1}{2}$;	702	15	6
(4) *Ans.*	302	9	2 ;	423	8	10 ;	544	8	6
(5) *Ans.*	454	1	9 ;	605	9	0 ;	681	2	$7\frac{1}{2}$
(6) *Ans.*	884	13	$0\frac{3}{4}$;	2064	3	$9\frac{3}{4}$;	2653	19	$2\frac{1}{4}$
(7) *Ans.*	2757	15	$4\frac{1}{2}$;	3217	7	$11\frac{1}{4}$;	3677	0	6
(8) *Ans.*	5833	18	$6\frac{1}{2}$;	6417	6	$4\frac{3}{4}$;	7000	14	3
(9) *Ans.*	7967	13	$11\frac{1}{2}$;	8764	9	$4\frac{1}{4}$;	9561	4	9
(10) *Ans.*	3680	9	7 ;	4048	10	$6\frac{1}{2}$;	4416	11	6

(11) £29 17*s.* $6\frac{1}{4}$*d.* × 18

		6
178	5	$1\frac{1}{2}$
		3

£534 15 $4\frac{1}{2}$. *Ans.*

(12) £57 14*s.* $10\frac{1}{2}$*d.* × 20

		4
230	19	6
		5

£1154 17 6. *Ans.*

(13) £130 5*s.* 10*d.* × 45

		9
1172	12	6
		5

£5863 2 6. *Ans.*

(14) £20 18*s.* $6\frac{1}{4}$*d.* × 64

		8
167	8	2
		8

£1339 5 4. *Ans.*

(15) £65 13*s.* $7\frac{1}{2}$*d.* × 108

		12
788	3	6
		9

£7093 11 6. *Ans.*

(16) £139 6*s.* 9*d.* × 132

		12
1672	1	0
		11

£18392 11 0. *Ans.*

(17) £264 12*s.* $9\frac{1}{4}$*d.* × 19
12+7 times

3175	13	3
1852	9	$4\frac{3}{4}$
£5028	2	$7\frac{3}{4}$. *Ans.*

(18) £225 17*s.* $11\frac{3}{4}$*d.* × 98
11×9−1

2484	17	$9\frac{1}{4}$
		9
22363	19	$11\frac{1}{4}$
£22138	1	$11\frac{1}{2}$. *Ans.*

(19) £64 7*s.* 11*d.* × 105
3×7×5

193	3	9
		7
1352	6	3
		5
£6761	11	3. *Ans.*

(20) £119 8*s.* $3\frac{1}{2}$*d.* × 124
12×10+4

1432	19	6
		10
14329	15	0
477	13	2
£14807	8	2. *Ans.*

(21) £89 10*s.* $10\frac{3}{4}$*d.* × 280
4×7×10

358	3	7
		7
2507	5	1
		10
£25072	10	10. *Ans.*

(22) £79 12*s.* $7\frac{3}{4}$*d.* × 173
173

£13776	7	$8\frac{3}{4}$. *Ans.*

(23) £365 9*s.* $2\frac{1}{2}$*d.* × 365
365

£133393	1	$0\frac{1}{2}$. *Ans.*

(24) £284 13*s.* 6*d.* × 247
247

£70314	14	6. *Ans.*

(25) *Ans.* 143 cwt. 2 qrs. 11 lbs.

(26) *Ans.* 44 t. 4 cwt. 2 qrs. 20 lbs.

(27)

cwt.	qrs.	lbs.	oz.	
26	0	19	13	×13
			12	+1
314	0	13	12	
340	1	5	9. *Ans.*	

(28)

lbs.	oz.	dwt.	grs.	
5	9	17	16	×25
			5	×5
29	1	8	8	
			5	
145	7	1	16. *Ans.*	

(29)

ac.	ro.	po.	
17	2	37	×69
		10	×7−1
177	1	10	
		7	
1241	0	30	
1223	1	33. *Ans.*	

(30)

da.	hrs.	min.	sec.	
9	11	43	33	×73
			12	×6+1
113	20	42	36	
			6	
683	4	15	36	
692	15	59	9. *Ans.*	

COMPOUND DIVISION.

Ex. 14.

(1) £28 1*s.* 3*d.* ÷ £1 17*s.* 5*d.* $= \frac{6735d.}{449d.} = 15.$ *Ans.*

(2) £68 7*s.* 11*d.* ÷ 19*s.* $6\frac{1}{2}d. = \frac{32830\ hf.\ d.}{469\ hf.\ d.} = 70.$ *Ans.*

(3) £261 12*s.* 6*d.* × 8 = 2093 *hf. crs.* ÷ £2 17*s.* 6*d.* × 8 = 23 *hf. crs.* = 91. *Ans.*

(4) £1 6*s.* $3\frac{1}{4}d.$ ÷ 3*s.* $9\frac{1}{2}d. = \frac{1261f.}{182f.} = \frac{97}{14} = 6\frac{13}{14}.$ *Ans.*

(5) £626 7*s.* ÷ £26 1*s.* $11\frac{1}{2}d. = \frac{12527 \times 12 \times 2\ hf.\ d.}{12527\ hf.\ d.} = 24.$ *Ans.*

(6) £384 3*s.* 6*d.* × 20 = 7683*s.* × 6 = 46101 *twop.* ÷ £23 5*s.* 8*d.* × 20 = 465*s.* × 6 = 2794 *twop.* $= \frac{4191}{254} = \frac{33}{2} = 16\frac{1}{2}.$ *Ans.*

(7) £321 10*s.* $3\frac{3}{4}d.$ ÷ £5 12*s.* $9\frac{3}{4}d. = \frac{308655f.}{5415f.} = 57.$ *Ans.*

(8) £100 ÷ £11 12*s.* 6*d.* $= \frac{800\ hf.\ crs.}{93\ hf.\ crs.} = 8\frac{56}{93}.$ *Ans.*

(9) £8 0*s.* $11\frac{1}{2}d.$ ÷ 39*s.* 6*d.* $= \frac{3863\ hf.\ d.}{948\ hf.\ d.} = 4\frac{71}{948}.$ *Ans.*

(10) £123 12*s.* 2*d.* ÷ £4 8*s.* $3\frac{1}{2}d = \frac{59332\ hf.\ d.}{2119\ hf.\ d.} = 28.$ *Ans.*

(11) £399 0*s.* $6\frac{3}{4}d.$ ÷ £12 17*s.* $5\frac{1}{4}d. = \frac{383067f.}{12357f.} = 31.$ *Ans.*

(12) £988 13*s.* 0½*d.* ÷ £30 0*s.* 10*d.* $= \frac{474553\ hf.\ d.}{14420\ hf.\ d.} = 32\frac{13113}{14420}$. *Ans.*

(13) 1136 cwt. 2 qrs. 2 lbs. ÷ 35 cwt. 2 qrs. 1 lb. 13 oz.
$= \frac{127290 \times 16\ oz.}{63645\ oz.} = 2 \times 16 = 32$. *Ans.*

(14) 10 t. 18 cwt. 2½ qrs. ÷ 12 cwt. 1½ qr.
$= 1749$ hf. qrs. $\div 99$ hf. qrs. $= 17\frac{2}{3}$. *Ans.*

(15) 17 mi. 3 fur. 162 yds. 9 in. ÷ 9 ft. 11 in.
$= \frac{1106721\ in.}{119\ in.} = \frac{158103}{17} = 9300\frac{3}{17}$. *Ans.*

(16) 12245 qu. ÷ 61 qu. 5 bu. 3 pks.
$= \frac{12245 \times 8 \times 4\ pks.}{1975\ pks.} = \frac{31 \times 32}{5} = 198\frac{2}{5}$. *Ans.*

Ex. 15.

		£	*s.*	*d.*		£	*s.*	*d.*		£	*s.*	*d.*
(1)	*Ans.*	29	18	10	(2)	36	15	9½	(3)	38	16	5¾
(4)	*Ans.*	0	17	10⅔	(5)	57	13	10½	(6)	9	10	3¾
(7)	*Ans.*	9	10	3¼	(8)	14	6	2$\frac{1}{14}$	(9)	3	13	11½
(10)	*Ans.*	25	11	11$\frac{20}{36}$	(11)	9	4	6$\frac{7}{11}$	(12)	3	0	11½

(13) 16 { 4) £75 4*s.* 4*d.*
4) 18 16 1
Ans. £4 14 0¼

(14) 18 { 2) £175 9*s.* 8*d.*
9) 87 14 10
Ans. £9 14 11⅞

(15) 19) £900 13*s.* 7*d.* (£47 8*s.* 1*d.* *Ans.*
76
140
133
7
20
153*s.*
152
1
12
19*d.*
19

(16) 23) £80 0*s.* 5*d.* (£3 9*s.* 7*d.* *Ans.*
69
11
20
220*s.*
207
13
12
161*d.*
161

(17) $28\left\{\begin{array}{l}4)\ 17s.\ 11\frac{1}{2}d.\\ 7)\ 4\quad 5\frac{7}{8}\end{array}\right.$

Ans. 0s. $7\frac{29}{56}$

(18) $36\left\{\begin{array}{l}6)\ £114\ 19s.\ 4\frac{1}{2}d.\\ 6)\ 19\quad 3\quad 2\frac{3}{4}\end{array}\right.$

Ans. £3 3 $10\frac{11}{24}$

(19) £10 6s. $5\frac{1}{2}d.$

20

34) 206s. (6s. $0\frac{59}{68}d.$ *Ans.*

204

2

12

$29\frac{1}{2}d.$

$\frac{34}{34} = \frac{59}{68}d.$

(20) 47) £537 11s. 3d. (£11 8s. 9d. *Ans.*

517

20

20

411s.

376

35

12

423d.

423

(21) $54\left\{\begin{array}{l}9)\ £136\ 14s.\ 10\frac{1}{2}d.\\ 6)\ 15\quad 3\quad 10\frac{1}{2}\end{array}\right.$

Ans. £2 10 $7\frac{3}{4}$

(22) $84\left\{\begin{array}{l}12)\ £100\quad 0s.\quad 0d.\\ 7)\ 8\quad 6\quad 8\end{array}\right.$

Ans. £1 3 $9\frac{5}{7}$

(23) 3,5s. $7\frac{1}{2}d.$

12

6,7d.

4

$3,0f. = \frac{3}{4}d.$

Ans. = 3s. $6\frac{3}{4}d.$

(24) £3,64 7s. 6d.

20

12,87s.

12

$10,50d. = 10\frac{1}{2}d.$

Ans. = £3 12s. $10\frac{1}{2}d.$

(25) 11,51s. 5d.

12

$6,17d. = 6\frac{17}{100}d.$

Ans. 11s. $6\frac{17}{100}d.$

(26) $120\left\{\begin{array}{l}6)\ £701\ 13s.\ 3d.\\ 20)\ 116\ 18\ 10\frac{1}{2}\end{array}\right.$

Ans. £5 16 $11\frac{13}{40}$

(27) $180\left\{\begin{array}{l}9)\ £316\ 12s.\ 4\frac{1}{2}d.\\ 20)\ 35\quad 3\quad 7\frac{1}{6}\end{array}\right.$

Ans. £1 15 $2\frac{19}{120}$

(28) $144\left\{\begin{array}{l}12)\ £93\ 14s.\ 8\frac{1}{4}d.\\ 12)\ 7\ 16\ 2\frac{11}{16}\end{array}\right.$

Ans. £0 13 $0\frac{43}{192}$

(29)

235) £524 1*s.* (£2 4*s.* $7\frac{1}{5}$*d.*
470 *Ans.*
54
20
1081*s.*
940
141
12
1692*d.*
1645
47*d.*
$\frac{47}{235} = \frac{1}{5}$*d.*

(30)

365) £984 14*s.* $9\frac{1}{2}$*d.* (£2 13*s.* $11\frac{1}{2}$*d.*
730 *Ans.*
254
20
5094*s.*
365
1444
1095
349
12
$4197\frac{1}{2}$*d.*
4015
$182\frac{1}{2}$*d.*
$\frac{182\frac{1}{2}}{365} = \frac{1}{2}$*d.*

(31)

252 { 7) £251 2*s.* $0\frac{3}{4}$*d.*
3) 35 17 $5\frac{1}{4}$
12) 11 19 $1\frac{3}{3}$
Ans. £0 19 $11\frac{7}{48}$

(32)

569) £596 17*s.* $1\frac{3}{4}$*d.* (£1 0*s.* $11\frac{3}{4}$*d.*
569 *Ans.*
27
20
557
12
$6685\frac{3}{4}$*d.*
6259
$426\frac{3}{4}$*d.*
$\frac{426\frac{3}{4}}{569} = \frac{1707}{569 \times 4} = \frac{3}{4}$*d.*

(33)

cwt. qrs. lbs.
29) 207 3 19 (7 cwt. 19 lbs. *Ans.*
203
4
4
19 qrs.
28
551 lbs.
29
261
261

(34)

cwt. qrs. lbs.
35 { 7) 541 0 14
5) 77 1 6
15 1 $23\frac{3}{5}$. *Ans.*

(35)

yds. qrs. na.

$$21\left\{\begin{array}{l}7)\ 18\ \ 3\ \ 1\\ 3)\ 2\ \ 2\ \ 3\end{array}\right.$$

Ans. 0 3 $2\frac{1}{3}$

(36)

da. ho. min. da. ho. min.

483) 1695 14 40 (3 12 $15\frac{5}{21}$. *Ans.*

1449

246

24

5918 ho.

5796

122

60

7360 min.

483

2530

2415

115 min. $=\frac{5}{21}$ min.

483

(37)

ac. ro. po.

90,75 0 4

4

3,00 ro.

40

0,04 po. $=\frac{4}{100}=\frac{1}{25}$ po.

Ans. 90 3 $0\frac{1}{25}$

(38)

mi. fur. po.

$$2800\left\{\begin{array}{l}4)\ 18396\ \ 7\ \ 0\\ 7)\ 4599\ \ 1\ \ 30\\ 100)\ 657\ \ 0\ \ 10\end{array}\right.$$

Ans. 6 4 $22\frac{1}{2}$

Supplement to Compound Multiplication, etc.

Ex. 16.

(1) £237 8*s.* 6*d.* $\times\frac{5}{9}$

5

9) 1187 2 6

£131 18 $0\frac{2}{3}$. *Ans.*

(2) £9 17*s.* 6*d.* $\times\frac{7}{8}$

7

8) 69 2 6

£8 12 $9\frac{3}{4}$. *Ans.*

(3) 16*s.* $0\frac{1}{2}$*d.* $\times\frac{13}{21}$

13

21) 208 $6\frac{1}{2}$

9*s.* $11\frac{1}{6}$*d.* *Ans.*

(4) £27 17*s.* $9\frac{1}{2}$*d.* $\times\frac{17}{2}$

17

2) 474 2 $5\frac{1}{2}$

£237 1 $2\frac{3}{4}$. *Ans.*

(5) £179 10*s.* $11\frac{1}{4}$*d.* $\times\frac{23}{3}$

23

3) 4129 11 $6\frac{3}{4}$

£1376 10 $6\frac{1}{4}$. *Ans.*

(6) £360 6*s.* $0\frac{3}{4}$*d.* $\times\frac{66}{7}$

66

7) 23780 0 $1\frac{1}{2}$

£3397 2 $10\frac{1}{4}$. *Ans.*

(7) £0 3s. $6\frac{1}{4}d. \times \frac{166}{13}$

166

13) 29 4 $5\frac{1}{2}$

£2 4 $11\frac{1}{2}$. *Ans.*

(8) £78 11s. $11\frac{1}{2}d. \times \frac{389}{20}$

389

20) 30574 11 $9\frac{1}{2}$

£1528 14 $7\frac{3}{40}$. *Ans.*

(9) yds. ft. in. $9 \quad 2 \quad 9\frac{1}{2} \times \frac{4}{17}$

4

17) 39 2 2

2 1 $0\frac{2}{17}$. *Ans.*

(10) cwt. qrs. lbs. $18 \quad 3 \quad 10 \times \frac{297}{14}$

297

14) 5595 1 2

399 2 $18\frac{1}{7}$. *Ans*

(11) mi. fur. po. yds. 7 3 27 3

8

59 fur.

40

2387 po.

$5\frac{1}{2}$

$11938\frac{1}{2}$

11938

$13131\frac{1}{2}$ yds.

$13131\frac{1}{2}$ yds.

3

$39394\frac{1}{2}$ ft.

12

472734 in. *Ans.*

(12) ac. ro. po. yds. 3 2 31 23

4

14 ro.

40

591 po.

$30\frac{1}{4}$

$17753\frac{3}{4}$

17753

$17900\frac{3}{4}$ yds.

$17900\frac{3}{4}$ yds.

9

$161106\frac{3}{4}$ ft.

12

1933281

12

23199372 sq. in. *Ans.*

(13) ac. ro. po. yds. ft. 12 3 0 13 5

4

51 ro.

40

2040 po.

$30\frac{1}{4}$

510

61213

61723 yds.

61723 yds. 5 ft.

9

555512 sq. ft. *Ans.*

(14)

sc.	ro.	po.	yds.
5	0	18	25
4			
20 ro.			
40			
818 po.			
$30\frac{1}{4}$			
$204\frac{1}{2}$			
24565			
$24769\frac{1}{2}$ yds.			

$24769\frac{1}{2}$ yds.
9
$222925\frac{1}{2}$ ft.
12
2675106
12
32101272 sq. in. *Ans.*

Ex. 17.

(1) $0\frac{3}{8}$) £11 13*s.* 7*d.*
8 8
3)93 8 8
£31 2 $10\frac{3}{8}$. *Ans.*

(2) $0\frac{11}{12}$) £146 16*s.* $3\frac{3}{4}$*d.*
12 12
11)1761 15 9
£160 3 3. *Ans.*

(3) $7\frac{1}{2}$) £4 19*s.* $10\frac{3}{4}$*d.*
2 2
15)9 19 $9\frac{1}{2}$
£0 13 $8\frac{5}{6}$. *Ans.*

(4) $8\frac{4}{5}$) £69 0*s.* 6*d.*
5 5
44)345 2 6
£7 16 $10\frac{1}{2}$. *Ans.*

(5) $10\frac{1}{9}$) £417 12*s.* $7\frac{1}{2}$*d.*
9 9
91)3758 13 $7\frac{1}{2}$
£41 6 $1\frac{1}{152}$. *Ans.*

(6) $15\frac{5}{6}$) £78 17*s.* $9\frac{1}{2}$*d.*
6 6
95) 473 6 9
£4 19 $7\frac{4}{5}$. *Ans.*

(7) $2\frac{39}{40}$) 16*s.* $2\frac{1}{4}$*d.*
40 40
119) 647 6
5*s.* $5\frac{6}{17}$*d.* *Ans.*

(8) $27\frac{7}{31}$) £700 13*s.* $2\frac{3}{4}$*d.*
27 27
736)18917 17 $2\frac{1}{4}$
£25 14 $0\frac{111}{128}$. *Ans.*

(9)

	lbs.	oz.	dwt.
$12\frac{3}{7}$)	173	9	2
7			7
87)	1216	3	14
	13	11	$15\frac{1}{3}$. *Ans.*

(10)

	da.	ho.	min.
$10\frac{3}{13}$)	12	4	55
13			13
133)	158	15	55
	1	4	$37\frac{6}{7}$. *Ans.*

(11) $30\frac{1}{4}$ — 4 — 121 { 11) 188848 qr. yds. ; 11) 17168 — 1560 po. 88 qr. yds.

47212 sq. yds. × 4

40) 1560 po. 22 yds. — 4) 39 ro. — 9 ac. 3 ro. 22 yds. *Ans.*

(12) 144 { 12) 6912000 sq. in. ; 12) 576000 ; 9) 48000 ft. — 5333 yds. 3 ft.

$30\frac{1}{4}$ — 4 — 121 { 11) 21332 qr. yds. ; 11) 1939 .. 3 — 40) 176 po. 36 qr. yds. — 4 ro. 16 po. 9 yds.

5333 yds. 3 ft. × 4

Ans. 1 ac. 16 po. 9 yds. 3 ft.

(13)

144 { 12) 15790875 sq. in. ; 12) 1315906 .. 3 ; 9) 109658 ft. 123 in. — 12184 yds. 2 ft.

$30\frac{1}{4}$ — 4 — 121 { 11) 48736 qr. yds. ; 11) 4430 .. 6 — 40) 402 po. 94 qr. yds. = 10 ro. 2 po. $23\frac{1}{2}$ yds.

12184 yds. 2 ft. 123 in. × 4

ac.	ro.	po.	yds.	ft.	in.
2	2	2	23	4	72
				2	123
2	2	2	23	7	51

Ans.

(14) 60) 2010650 min.

24 { 2) 33510 ho. 50 min. ; 12) 16755

$365\frac{1}{4}$ — 4 — 1461) 1396 — 4 — 5585

$1396\frac{1}{4}$ da.

3 yrs. 1202 qr. da. = 3 yrs. 300 da. 12 ho.

Ans. 3 yrs. 300 da. 12 ho. 50 min.

MISCELLANEOUS EXERCISES.

Ex. 18.

(1) $1526+2986+957+3879=9348$;

$$\frac{9348}{19}\times 76=9348\times 4=37392.\ \textit{Ans.}$$

(2) Sum of given quantities, £150 4*s.* 7*d.*=36055*d.*;
also, £57 9*s.* 8*d.* − £19 18*s.* $6\frac{1}{4}$*d.*=£37 11*s.* $1\frac{3}{4}$*d.*=36055*f.*;
therefore, 36055*d.* ÷ 36055*f.*=4. *Ans.*

(3) The no. of dozens will be just the no. of times that the whole amount contains the price of 1 dozen; hence,

$$\frac{£13\ 5s.\ 6d.}{2s.\ 5\frac{1}{2}d.\times 12}=\frac{£13\ 5s.\ 6d.}{29s.\ 6d.}=\frac{531\ sixp.}{59\ sixp.}=9\text{ doz. }\textit{Ans.}$$

(4) Here, 190 *crs* = £47 10*s.* 0*d.*
11 *flor.* = 1 2 0
0 0 10
£48 12 10

30 *guin.* = £31 10*s.* 0*d.*
9 *hf. crs.* = 1 2 6
0 0 $7\frac{1}{2}$
£32 13 $1\frac{1}{2}$

£48 12*s.* 10*d.* − £32 13*s.* $1\frac{1}{2}$*d.* = £15 19*s.* $8\frac{1}{2}$*d. Ans.*

(5) 497 st. @ $\frac{23}{4}$*d.*
23
4) 11431
$2857\frac{3}{4}$*d.* = £11 18*s.* $1\frac{3}{4}$*d.*

$19\frac{1}{2}$ tons @ £1 18*s.* 10*d.*
$19\frac{1}{2}$
0 19 5
36 17 10
$19\frac{1}{2}$ tons potatoes @ 38*s.* 10*d.* = £37 17 3
497 stones hay @ 0 $5\frac{3}{4}$ = 11 18 $1\frac{3}{4}$
Ans. £49 15 $4\frac{3}{4}$

(6) £1359 13*s.* 2*d.* ÷ £1 9*s.* 11*d.* = 326318*d.* ÷ 359*d.* = 908 times, with 346*d.*, or 28*s.* 10*d.*, remaining. *Ans.*

(7) 11272*s.* 6*d.*
8
90180 *thr. hf. d.* ÷ 133 *thr. hf. d.* = 678 pieces,

16*s.* $7\frac{1}{2}$*d.*
8
with 6 *thr. hf. d.*, or 9*d.*, rem. *Ans.*

(8) Daily income, $£219 \div 365 = \frac{20s. \times 219}{5 \times 73} = 4s. \times 3 = 12s.$;

$12s. - 8s.\ 6d. = 3s.\ 6d.$ saved per day; and this daily saving would amount to 30 *guin.* in $(30 \times 21) \div 3\frac{1}{2} = 60 \times 3 = 180$ da. *Ans.*

(9)

ac.	ro.	po.	
144	3	$8\frac{3}{4} \times 1\frac{8}{11}$	
		19	
2751	1	$6\frac{1}{4} \div 11 = 250$	ac. 0 ro. $18\frac{3}{4}$ po. *Ans.*

Ex. 19.

(1) $£1267\ 17s. - £79\ 19s. = £1187\ 18s.$;

$\frac{£1187\ 18s.}{14} \times 21 = £1187\ 18s. \times 1\frac{1}{2} = £1781\ 17s.$ *Ans.*

(2) $12000 + 1212 + 11000 + 1111 = 25323$;

$\frac{25323 - 925}{242} = \frac{24398}{242} = \frac{1109}{11} = 100\frac{9}{11}$. *Ans.*

(3)

	£1425	1s.	$2\frac{1}{4}d. \div 19 =$	£75	0s. $0\frac{3}{4}d.$
2s. 6d. × 31 =	£3		17s. 6d.		
2s. 0d. × 17 =	1	14	0		
	0	1	$0\frac{3}{4}$	5	12 $6\frac{3}{4}$
				37) 89	7 6
				£1	17 6 *Ans.*

(4) No. of subtractions = 123 cwt. 3 qrs. 12 lbs. ÷ 18 cwt. 1 qr. 16 lbs. = 13872 lbs. ÷ 2060 lbs. = 6, with a rem. of 1512 lbs.;
1512 lbs. @ $4\frac{3}{4}d.$ per lb. = £29 18s. 6d. *Ans.*

(5)

17 bu. @ 5s. 6d. a bu. =	£4	13s.	6d.
408 st. @ $2\frac{1}{2}d.$ a st. =	4	5	0
	£8	18	6

£8 18s. 6d. = £8 8s. + 10s. 6d. = $8\frac{1}{2}$ *guin.* *Ans.*

(6) $£60\ 4s.\ 5\frac{3}{4}d. \div \frac{1}{2}(£16\ 9s.\ 4\frac{1}{2}d. - £14\ 10s.\ 6d.)$
$= £60\ 4s.\ 5\frac{3}{4}d. \times 2 \div £1\ 18s.\ 10\frac{1}{4}d.$
$= 115630f. \div 1865f. = 62.$ *Ans.*

(7) 65 yds. @ 7*s.* 8*d.* amount to 92*d.* × 65; and as the no. of times that amount contains 9*s.* 7*d.*, or 115*d.*, there will be so many yards at 115*d.*

$$\frac{92d. \times 65}{115d.} = 4 \times 13 = 52 \text{ yds. } \textit{Ans.}$$

(8) £360 18*s.* 9*d.* × 4 = £1443 15*s.* 0*d.* yearly income
£864 + 864*s.* = 907 4 0 yearly reserve
365) 536 11 0 yearly expend.
Ans. £1 9 $4\frac{4}{5}$ daily expend.

(9) £101 10*s.* 4*d.* $3\frac{5}{9}$
9 9
£913 13 0 + 32 = £28 11*s.* $0\frac{3}{8}$*d.* *Ans.*

Ex. 20.

(1) Profit per yard = 23*s.* 6*d.* − 19*s.* 9*d.* = 3*s.* 9*d.*; therefore,
45*d.* × 315 = £59 1*s.* 3*d.* *Ans.*

(2) Cost of 232 pair of rabbits = 87 times 6*s.* 4*d.*; therefore,

$$\text{cost of 1 pair} = \frac{76d. \times 87}{232} = \frac{19d. \times 3}{2} = 2s.\ 4\tfrac{1}{2}d. \textit{ Ans.}$$

(3) Cost per box = $10\frac{1}{2}$*d.* × 5; and there will be so many boxes as the no. of times that cost is contained in $2\frac{1}{2}$ *guineas*; therefore, the guineas being reduced to pence, we have

$$\frac{2\frac{1}{2} \times 21 \times 12d.}{10\frac{1}{2}d. \times 5} = \frac{5 \times 21 \times 12}{21 \times 5} = 12 \text{ boxes. } \textit{Ans.}$$

(4) 63 qu. 6 bu. = 510 bu. @ 64 lbs. each; which in cwt. amounts to $\frac{64 \times 510}{112} = 2040 \div 7 = 291\frac{3}{7}$ cwt. = 14 t. 11 cwt. 48 lbs. *Ans.*

Also, 37*s.* 4*d.* ÷ 8 = 4*s.* 8*d.* a bushel; and 510 bu. @ 56*d.* = £119. *Ans.*

(5)
yd.	ft.	in.	
1	1	1 × 47	
		47	
63	2	11 *Ans.*	

Also, 1 yd. + 1 ft. + 1 in. = 49 inches; 5 mi. 902 yds. = 9702 × 36 inches; which ÷ 49 in. gives 198 × 36, = 7128 of each. *Ans.*

(6) 17 gal. of spirits are worth $26s. \times 17$; and this is to be the worth of $19\frac{1}{2}$ gal. of the mixture, which is, per gallon,

$$= \frac{26s. \times 17}{19\frac{1}{2}} = \frac{26s. \times 34}{39} = \frac{2s. \times 34}{3} = 22s.\ 8d.\ \textit{Ans.}$$

(7) The whole value of the mixture is to be $19s.\ 6d. \times 51$, which, at $18s.$ for each gallon, gives $\frac{19\frac{1}{2}s. \times 51}{18s.} = \frac{39 \times 51}{18 \times 2} = \frac{13 \times 17}{4}$ $= 55\frac{1}{4}$ gal. in the mixture; hence, $55\frac{1}{4} - 51 = 4\frac{1}{4}$ gal. water. *Ans.*

(8) The younger will get 1 share,
the elder will get 1 such share + $14d.$
or, the whole sum is = 2 shares and $14d.$ more;
therefore, $(14s. - 14d.) \div 2 = 7s. - 7d. = 6s.\ 5d.$ the younger
$14s. - 6s.\ 5d. = 7s.\ 7d.$ the elder } *Ans.*

(9) 29 sq. po. 22 sq. yds.
$30\frac{1}{4}$
$7\frac{1}{4}$
892
$899\frac{1}{4}$ sq. yds.

$899\frac{1}{4}$ sq. yds.
9
$8093\frac{1}{4}$ sq. ft.
$= 8093$ sq. ft. $+ \frac{1}{4}$ of 144 sq. in.
$= 8093$ sq. ft. 36 in. *Ans.*

Ex. 21.

(1) $160s.\ 10\frac{1}{2}d. \div 11s.\ 8\frac{1}{4}d. = 7722f. \div 561f. = 702 \div 51$
$= 234 \div 17 = 13\frac{13}{17}$ yds. *Ans.*

(2) Yearly expenditure = £8 15*s.* 6*d.* × 52 = £456 6*s.*
Yearly reserve 193 14
Yearly income £650 0 *Ans.*

(3) $4s.\ 10d. \times 23 = 111s.\ 2d.$
$133 \quad 9\frac{1}{2} \div 19 = 7 \quad 0\frac{1}{2}$
$104 \quad 1\frac{1}{2} \times \frac{84}{19} = 104s.\ 1\frac{1}{2}d. \times \frac{12}{7}$
$= £8\ 18s.\ 6d.$ *Ans.*

(4) Whole value of the rupees = $15s.\ 8d. \times 365$, which, at $1s.\ 11\frac{1}{2}d.$ each, gives $\frac{188d. \times 365}{23\frac{1}{2}d.} = \frac{188 \times 730}{47} = 4 \times 730 = 2920$ *rup. Ans.*

(5) *M* will have 1 share, *W* 3 shares; in all, 4 of *M*'s shares $= 30s.$; hence $30s. \div 4 = 7s.\ 6d.$ to *M*, $22s.\ 6d.$ to *W*. *Ans.*

(6) $20s. - 7s.\ 1d. = 12s.\ 11d.$ paid for the required quantity, at $(8d. + 5d. + 18d.)$ per lb.; hence, $12s.\ 11d. + 31d. = 5$ lbs. of each. *Ans.*

(7) The less no. is 1 quantity,
the greater is 1 such quantity + 234;
sum of both = 2 such quantities + 234;
therefore, 567 − 234 will be the sum of two quantities each equal to the smaller no.; hence $333 \div 2 = 166\frac{1}{2}$ the less, and $166\frac{1}{2} + 234 = 400\frac{1}{2}$ the greater. *Ans.*

(8) 12 lbs. is half as much again as 8 lbs., therefore 12 lbs. of corn cost $4\frac{1}{2}d. \times 1\frac{1}{2} = 6\frac{3}{4}d.$; also, 28 lbs. is 4 times as much as 7 lbs.; therefore, 28 lbs. of hay cost $2\frac{3}{4}d. \times 4 = 11d.$ Hence, $6\frac{3}{4}d. + 11d. = 17\frac{3}{4}d.$ per day; and $17\frac{3}{4}d. \times 17 = 25s.\ 1\frac{3}{4}d.$ *Ans.*

(9) Here, £76 19*s.* $8\frac{3}{13}d.$ is to be multiplied by $5\frac{4}{7}$ or $\frac{39}{7}$, or by $\frac{13 \times 3}{7}$; and, accordingly, we first multiply by 13, to remove the given fraction of a penny.

£	s.	$\frac{3}{13}d.$
		13
1000	15	11
		3
7) 3002	7	9
£428	18	3 *Ans.*

Ex. 22.

(1) $\frac{£14 \times 273 \times 2\frac{1}{4}}{156 \times 81} = \frac{£14 \times \overset{21}{\cancel{273}} \times 9}{\underset{12}{\cancel{156}} \times \underset{9}{\cancel{81}} \times 4} = \frac{£7 \times 7}{2 \times 9 \times 4} = 13s.\ 7\frac{1}{2}d.$ *Ans.*

(2) No. of times that 7225 *francs* contains $25\frac{1}{2}$ *francs*
$= \frac{7225}{25\frac{1}{2}} = \frac{14450}{51} = \frac{850}{3}$; hence, $20s. \times \frac{1}{3}$ of 850
$= \frac{1}{3}$ of £850 = £283 6*s.* 8*d.* *Ans.*

(3) *B* will get 1 share
A „ 1 such share + £1 6*s.* 7*d.*
£10 13*s.* 2*d.* = 2 shares of *B* + £1 6*s.* 7*d.*

£	s.	d.		
£1	6	7		
£9	6	7	÷ 2 =	£4 13*s.* $3\frac{1}{2}d.$ *B*'s share
1	6	7	more =	£5 19 $10\frac{1}{2}$ *A*'s share

Ans.

(4) 1 cwt. 1 qr. 1 lb. × the required no. is to be = 46 cwt. 2 qrs. 9 lbs.; that is, 141 lbs. × the required no. is to be = 5217 lbs.; hence, 5217 ÷ 141 = 37 of each. *Ans.*

(5) 77 gal. of diluted spirits are to be worth 36*s.* 8*d.* × 72; worth of 1 gal. $= \frac{440d. \times 72}{77}$; worth of $3\frac{1}{2}$ gal. $= \frac{440d. \times 72 \times 3\frac{1}{2}}{77}$

$= \frac{440d. \times 36 \times 7}{77} = 40d. \times 36 = 40s. \times 3 = £6$. *Ans.*

(6) 134 ac. 5 po. is to be resolved into 1 share + $1\frac{1}{2}$ share, or $2\frac{1}{2}$ shares; hence, 134 ac. 5 po. ÷ $2\frac{1}{2}$ = 268 ac. 10 po. ÷ 5

	ac.	ro.	po.	
	= 53	2	18 to *D*	*Ans.*
$1\frac{1}{2}$ of *D*'s = 80	1	27 to *C*		

(7) A stone = 14 lbs.; therefore 7 lbs. = $\frac{1}{2}$ a stone, and 35 lbs. = $2\frac{1}{2}$ stones; then, $2\frac{1}{2}$ stones of hay at 5*d.* = $12\frac{1}{2}d.$, and $\frac{1}{2}$ a stone of oats at $7\frac{1}{2}d. = 3\frac{3}{4}d.$; hence, $12\frac{1}{2}d. + 3\frac{3}{4}d. = 16\frac{1}{4}d.$ a day, which in 42 days will amount to $16\frac{1}{4}d. \times 42 = 682\frac{1}{2}d. = £2$ 16*s.* $10\frac{1}{2}d.$ *Ans.*

(8) 6 lbs. at 4*s.* 8*d.* = 28*s.*; 84 lbs. at 4*s.* 3*d.* = 357*s.*; 57 lbs. at 3*s.* 8*d.* = 209*s.*; sum 594*s.*, which ÷ 3 gives 198*s.*, the value of each person's share.

	lbs.
A gets the value of 28*s.* . . . . . =	6
and that of 170*s.* = 170*s.* ÷ 4*s.* 3*d.* =	40
357 / 170 — 198*s.* is the value of *A*'s	46
B gets the value of 187*s.* = 187*s.* ÷ 4*s.* 3*d.* =	44
and that of 11*s.* = 11*s.* ÷ 3*s.* 8*d.* =	3
209 / 11 — 198*s.* is the value of *B*'s	47
C gets the value of 198*s.* = 198*s.* ÷ 3*s.* 8*d.* =	54

Hence, *A* gets 46 lbs., *B* 47, *C* 54. *Ans.*

(9)

	yds.	ft.	in.
$3\frac{12}{17}$	52	1	$10\frac{1}{2}$
17			17
63 { 7) 894	1	$10\frac{1}{2}$	
9) 127	2	$4\frac{13}{14}$	
	14	0	$7\frac{3}{14}$ *Ans.*

Ex. 23.

(1) 358 yds. 2 qrs. 2 na. + 18 yds. 3 qrs. 2 na. = 5738 na. + 302 na. = 19 gowns. *Ans.*

(2) Profit per dozen = $9d. \times 12 - 6s.\ 4d. = 2s.\ 8d.$;
hence, total profit = $2s.\ 8d. \times 25 = £3\ 6s.\ 8d.$ *Ans.*

(3) $$\frac{12s.\ 10\frac{1}{2}d. \times 1078}{15s.\ 9d. \times 21 \times 5\frac{1}{2}} = \frac{103 \times 1078}{63 \times 21 \times 11} = \frac{103 \times 11 \times 98}{63 \times 21 \times 11} = \frac{103 \times 2}{9 \times 3} = 7\tfrac{17}{27}.$$ *Ans.*

(4)

351 *hf. crs.*	× 10	= 3510 ;	26 *crs.*	× 20	= 520
31 *sixp.*	× 2	= 62 ;	23 *fl.*	× 8	= 184
3*d.*	+ 3	= 1 ;	9*d.*	+ 3	= 3
		707			707

threep. 3573 (5 — *threep.*
3535

rem. = 38 *threep.* = 9*s.* 6*d.* *Ans.*

(5) 4 gal. of spirits at $20s. = 80s.$; and the same quantity of diluted spirits costs $75s.$; so that the whole quantity of diluted spirits calculated at $75s.$ amounts to the same as 54 gallons at $80s.$

Hence, $\frac{80s. \times 54}{75s.} = \frac{16 \times 18}{5} = 57\frac{3}{5}$ gal. diluted
54 „ undiluted
$3\frac{3}{5}$ gal. *Ans.*

(6) Larger field = 1 quantity
Smaller = 1 such quantity − 9 ac. 1 ro. 28 po.
Both together = 2 of the larger, all but 9 ac. 1 ro. 28 po.

ac.	ro.	po.	
21	1	10	
9	1	28	
30	2	38	+ 2 = 15 ac. 1 ro. 19 po. *Ans.*

(7) $4s.\ 10d. - 4s.\ 2\frac{1}{2}d. = 7\frac{1}{2}d.$, profit on each lb.;
therefore, $43s.\ 9d. + 7\frac{1}{2}d. = 350 + 5 = 70$ lbs. *Ans.*

(8) 60 salmon each $15\frac{3}{4}$ lbs.=945 lbs.; 50 each 14 lbs.=700 lbs.; 172 each $8\frac{3}{4}$ lbs.=1505 lbs.; sum 3150 lbs., which÷4 gives $787\frac{1}{2}$ lbs. the weight of each salesman's share.

	lbs.	lbs.	salmon.
A gets	$787\frac{1}{2}$	$\div 15\frac{3}{4}$	$=50$;
	945		
	$787\frac{1}{2}$		
B gets	$157\frac{1}{2}$	$\div 15\frac{3}{4}$	$=10$
and	630	$\div 14$	$=45$
	700 $787\frac{1}{2}$ is the weight of *B*'s		55;
	630		
C gets	70	$\div 14$	$=5$
and	$717\frac{1}{2}$	$\div 8\frac{3}{4}$	$=82$
	1505 $787\frac{1}{2}$ is the weight of *C*'s		87;
	$717\frac{1}{2}$		
D gets	$787\frac{1}{2}$	$\div 8\frac{3}{4}$	$=90$;

hence, *A* gets 50 salmon, *B* 55, *C* 87, *D* 90. *Ans.*

Also, $787\frac{1}{2}$ lbs. at $10\frac{1}{2}d.$=£34 9*s.* $0\frac{3}{4}d.$ *Ans.*

(9) 144 { 12) 724060 sq. in.
12) 60338 .. 4
9) 5028 ft. 28 in.
558 yds. 6 ft. 28 in.

$30\frac{1}{4}$ 4

121 { 11) 2232 qr. yds.
11) 202 .. 10
18 po. 54 qr. yds.=18 sq. po. 13 yds. 4 ft. 72 in.

6 ft. 28 in.

Ans. 18 sq. po. 14 yds. 1 ft. 100 in.

Ex. 24.

(1) $\frac{27 \text{ cwt. } 3 \text{ qrs. } 12 \text{ lbs.} \times 6\frac{1}{4}}{50} = \frac{27 \text{ cwt. } 3 \text{ qrs. } 12 \text{ lbs.}}{8}$

$=3$ cwt. 1 qr. 26 lbs. *Ans.*

(2) $\frac{85 \text{ mi.}}{15 \text{ ft. } 7 \text{ in.}} = \frac{85 \times 1760 \times 36 \text{ in.}}{187 \text{ in.}} = 5 \times 160 \times 36 = 28800$ times.

Ans.

(3) $(240+60+48)\ hf.\ d. \times 7 = 2496$. *Ans.*

(4)
20 gal. at 15*s.* = 300*s.*
12 „ „ 17 = 204
32 „ „ 20 = 640
24 „ „ 22 = 528
88) 1672*s.*
88 gal. amount to 1672*s.*, which is at 19*s.* a gal. *Ans.*

(5) $$\frac{27\text{ cwt. }19\text{ lbs.} \times 145\frac{1}{2}}{4\frac{1}{4} \times 485} = \frac{27\text{ cwt. }19\text{ lbs.} \times 291 \times 2}{17 \times 97 \times 5}$$
$$= \frac{27\text{ cwt. }19\text{ lbs.} \times 6}{85} = 1\text{ cwt. }3\text{ qrs. }18\tfrac{4}{5}\text{ lbs. } \textit{Ans.}$$

(6)
57 gal. at 7*s.* 10*d.* = 446*s.* 6*d.*
17 „ „ 9 6 = 161 6
2 „ „ 0 0 = 0 0
76) 608*s.*
The 76 gal. are worth 608*s.*, which is at 8*s.* a gal. *Ans.*

(7)
A will get 1 share
B „ „ 1 such share + 26*s.* 6*d.*
C „ „ 1 such share + 53 0
£45 0*s.* 0*d.* = 3 of *A*'s shares + 79 6
3 19 6
£41 0 6 ÷ 3 = £13 13*s.* 6*d.* to *A*
1 6 6 more = 15 0 0 *B*
1 6 6 more = 16 6 6 *C*
} *Ans.*

(8)
The 1st period will be 1 quantity
2nd „ „ 29 such quantities
3rd „ „ 116 „ „
365 days = 146 times the 1st period,
or, 5 days = 2 times the 1st period;
∴ $2\frac{1}{2}$ da. is the 1st period
$72\frac{1}{2}$ „ „ 2nd „
290 „ „ 3rd „
} *Ans.*

(9)
	ro.	po.	yd.	ft.	in.
7)	11	34	1	1	108
	1	27	21	6	144, or, 1 ro. 27 po. 21 yds. 7 ft. *Ans.*

Here the remainder after dividing the poles is 5 po. = $151\frac{1}{4}$ yds., and 1 added makes $152\frac{1}{4}$ yds., which ÷ 7 gives 21 yds. and $5\frac{1}{4}$ yds. remaining; this rem. × 9 gives $47\frac{1}{4}$ ft., and 1 added makes $48\frac{1}{4}$ ft., to be divided by 7; and so forth.

Ex. 25.

(1) The servant will earn £13 in 52 weeks,
or 1 in 4
or 5 in 20. *Ans.*

(2) 84 mi.=5280 ft.×84;

$$\frac{5280 \text{ ft.} \times 84}{9\frac{1}{3} \text{ ft.}} = \frac{5280 \times 84 \times 3}{28} = 47520 \text{ rev. by fore wheel}$$

$$\frac{5280 \text{ ft.} \times 84}{15\frac{3}{4} \text{ ft.}} = \frac{5280 \times 84 \times 4}{63} = 28160 \text{ by hind wheel}$$

Ans.

(3)
15	gal.	at	17*s.*	4*d.*	=260*s.*	0*d.*
28	„		18	7	=520	4
6	„		19	8	=118	0
49					)898	4
					18	4

+3*s.* 2*d.*=21*s.* 6*d.* *Ans.*

(4) The 1st sum will be 1 quantity
2nd „ „ 4 such quantities
3rd „ „ 20 „ „

£6 19*s.* 7*d.*÷25=£0 5*s.* 7*d.* the 1st
1 2 4 „ 2nd
5 11 8 „ 3rd
Ans.

(5) *B* will get 1 sum
A „ 1 such sum − 10*s.*
C „ 1 such sum − 10*s.* 6*d.*

£5 0*s.* 0*d.*=3 of *B*'s shares − 20*s.* 6*d.*

£6	0	6÷3=£2	0*s.*	2*d.*	to *B*		
		1	10	2	„ *A*		*Ans.*
		1	9	8	„ *C*		

(6) £45 1*s.* 4*d.*÷17*s.* 4*d.*=52 gal. bought
1 12 11
£46 14 3 ÷18*s.* 6*d.*=50½ gal. sold
Leakage 1½ gal. *Ans.*

(7) Amount from foot passengers=1 sum
" " carriages =1 such sum+12*s.* 6*d.*
£12 14*s.* 2*d.* =2 such sums+12*s.* 6*d.*
0 12 6
£12 1 8÷2=£6 0*s.* 10*d.* in all, from foot passengers
6 13 4 " " carriages
120*s.* 10*d.*÷$\frac{1}{2}$*d.*=2900 foot passengers
133 4 ÷2*d.*= 800 carriages } *Ans.*

(8) 17 women get 17 shares
23 men get 69 women's shares
3*s.* 7*d.*×30=86 women's shares
43*d.*×30÷86=30*d.*÷2=1*s.* 3*d.* each woman
3 9 each man } *Ans.*

(9)

mi.	fur.	po.	yd.	ft.	
3	5	21	1	2$\frac{1}{2}$	×45
				9	
33	1	31	5	1$\frac{1}{2}$	mi. fur. po.
					=33 1 32
					5
					166 1 0 *Ans.*

Ex. 26.

(1) 2 mi. 1430 yds.=4950 yds.=14850 ft.=880 revolutions;
∴ 14850 ft.÷880=135 ft.÷8=16 ft. 10$\frac{1}{2}$ in. *Ans.*

(2) 54 gal. at 9*s.* 7$\frac{1}{2}$*d.* = 519*s.* 9*d.*
63 " 8 11$\frac{1}{2}$ = 564 4$\frac{1}{2}$
Amt. at 8*s.* 7$\frac{1}{2}$*d.* a gal.=1084 1$\frac{1}{2}$
52038*f.*÷413*f.*=126 gal. diluted
117 " undiluted
Water 9 gal. *Ans.*

(3) 4 qrs.×52$\frac{1}{2}$÷5 qrs.=42 ells;
hence, the required no. of ells at 6*s.* 3*d.* will amount to 6*s.* 8*d.* ×42; or the no. of ells=$\frac{80d.\times 42}{75}=\frac{16\times 14}{5}$=44 ells 4 qrs. *Ans.*

(4) $\dfrac{60°\ 3'\ 36'' \times 12\frac{1}{2} \times 40\frac{1}{4}}{2°\ 6' \times 6\frac{1}{2} \times 126\frac{1}{2}} = \dfrac{19656}{7560} \dfrac{\text{sec.} \times 25 \times 161}{\text{sec.} \times 13 \times 253 \times 2}$

$\dfrac{1512 \times 25 \times 7}{1512 \times 5 \times 2} = \dfrac{35}{2} = 17\frac{1}{2}$. *Ans.*

(5) 5 men 9 you. 12 wom.

$28\frac{1}{2} + 12 = 40\frac{1}{2}$ wom.; $\therefore$ a wom. gets 1 2
a youth gets 1*s.* 2*d.* $\times 1\frac{1}{2} = 1$ 9
a man gets 1*s.* 9*d.* $\times 2 = 3$ 6 } *Ans.*

(6) $\dfrac{32s.}{5}$ per yd. $\times 63 \times 25 \times 9 \times 8 = 32s. \times 63 \times 9 \times 40$
$= £32 \times 63 \times 18 = £36288$. *Ans.*

(7) No. of yds. in each of 9 parcels $= \dfrac{84 \times 35 \times 8 \times 81}{30 \times 7 \times 9} = \dfrac{84 \times 8 \times 9}{6}$
$= 1008$ yds. in equal pieces of 42 yds. each;
1008 yds. $\div$ 42 yds. $= 24$ pieces. *Ans.*

(8) 1 man 2 wom. 3 boys receive $(3s.\ 8d. + 3s.\ 4d. + 3s.\ 6d.) \times 5\frac{1}{2}$ per week $= 57s.\ 9d.$; and £77 19*s.* 3*d.* $\div 57s.\ 9d. = 27$ times 1 man 2 wom. 3 boys $= 27$ m. 54 w. 81 b. *Ans.*

(9) If *A*'s share be represented by 10 equal quantities,
B's will be „ „ 9 such quantities,
A's and *B*'s together „ 19

	ac.	ro.	po.	yds.		ac.	ro.	po.	yds.	
19)	20	3	13	24						
	1	0	15	14	$\times 10 =$	10	3	34	19	to *A*
					$\times 9 =$	9	3	19	5	to *B*

Ans.

PROPORTION.

Ex. 27.

(1) $\frac{15\times28}{21}=\frac{15\times4}{3}=5\times4=20$. *Ans.*

(2) $\frac{85\times12}{20}=\frac{85\times3}{5}=17\times3=51$. *Ans.*

(3) $\frac{26\times132}{24}=\frac{26\times11}{2}=13\times11=143$. *Ans.*

(4) $\frac{17\frac{1}{4}s.\times52}{117}=\frac{69\times13}{117}=\frac{69}{9}=7\frac{2}{3}$. *Ans.*

(5) $\frac{15\text{ da.}\times24}{9}=\frac{15\text{ da.}\times8}{3}=5\text{ da.}\times8=40\text{ da.}$ *Ans.*

(6) $\frac{34\text{ in.}\times30}{51}=\frac{34\text{ in.}\times10}{17}=2\text{ in.}\times10=1\text{ ft. }8\text{ in.}$ *Ans.*

(7) $\frac{100\times666}{555}=\frac{100\times6}{5}=20\times6=120$. *Ans.*

(8) $\frac{817s.\times12}{9\frac{1}{2}}=\frac{817s.\times24}{19}=43s.\times24=£51\ 12s.$ *Ans.*

(9) cwt. qrs. lbs. : cwt. qrs. lbs. :: *s.* *d.*

10 2 14 : 4 0 2 :: 14 $10\frac{1}{2}$

8 8

85 0 0 : 450 lbs. :: 119 0

$\frac{119s.\times450}{85\times112}=\frac{7s.\times450}{5\times112}=\frac{90s.}{16}=5s.\ 7\frac{1}{2}d.$ *Ans.*

(10) $\frac{46\text{ oz.}\times391}{368}=\frac{391\text{ oz.}}{8}=48\text{ oz. }14\text{ drs.}=3\text{ lbs. }14\text{ drs.}$ *Ans.*

(11) $\frac{£1\times5247}{23320}=\frac{£477}{2120}=\frac{£9}{40}=9$ *sixp.* $=4s.\ 6d.$ *Ans.*

(12) gal. qts. : pts. :: £ *s.*

27 3 : $6\frac{1}{8}$ :: 27 15

4 8 4

111×8×8 : 49 :: 111 0

$\frac{£111\times49}{111\times8\times8}=\frac{£49}{64}=15s.\ 3\frac{3}{4}d.$ *Ans.*

(13) $\frac{2635\text{ lbs.}\times 5709}{8525}=\frac{5\text{ lbs.}\times 17\times 81\times 519\times 11}{5\times 155\times 11}=\frac{8823\text{ lbs.}}{5}$

$=1764\frac{3}{5}\text{ lbs.}=15\text{ cwt. }3\text{ qrs. }0\frac{3}{5}\text{ lb. } \textit{Ans.}$

(14) $\frac{1604\text{ mi. }6\text{ fur. }206\text{ yds.}\times 91212}{83611}=\frac{1604\text{ mi. \&c.}\times 8292}{7601}$

$=\frac{1604\text{ mi. \&c.}\times 12\times 691}{11\times 691}$

	mi.	fur.	yds.
$\frac{1}{11}=$	145	7	$38\frac{8}{11}$
Ans.	1750	6	$24\frac{8}{11}$

SIMPLE RULE OF THREE.

Ex. 28.

(1) 15 lbs. : 25 lbs. :: 18*s.* : 18*s.*$\times 25\div 15=30s.$ *Ans.*

(2) 28*s.* : 16*s.* :: 63 lbs. : 63 lbs.$\times 16\div 28=36$ lbs. *Ans.*

(3) 26 yds. : 65 yds. :: £9 : £9$\times 65\div 26=$£22 10*s.* *Ans.*

(4) 84 mi. : 91 mi. :: 2388 rev. : 2587 rev. *Ans.*

(5) 35*s.* : 28*s.* :: 85 copies : 68 copies. *Ans.*

(6) 75 qu. : $62\frac{1}{2}$ qu. :: 294 cwt. : 245 cwt. *Ans.*

(7) 28 m. : 24 m. :: 21 da. : 18 da. *Ans.*

(8) 18 da. : $13\frac{1}{3}$ da. :: 12 sheep : 9 sheep. *Ans.*

(9) 30 sh. : 18 sh. :: 20 da. : 12 days. *Ans.*

(10) 154 or. : 105 or. :: 13*s.* 9*d.* : 9*s.* $4\frac{1}{2}d.$ *Ans.*

(11) 12 ap. : 20 ap. :: $10\frac{1}{2}d.$: $17\frac{1}{2}d.$ *Ans.*

(12) $17\frac{1}{2}d.$: 21*d.* :: 20 ap. : 24 ap. *Ans.*

(13) £57 : £41 16*s.* :: $22\frac{1}{2}$ qu. : $\frac{45}{2}$ qu.$\times\frac{202}{5}\times\frac{1}{57}=\frac{9}{2}$ qu.$\times\frac{11}{3}=\frac{33}{2}$, or $16\frac{1}{2}$ qu. *Ans.*

(14) 17*s.* 6*d.* : 20*s.* 5*d.* :: $13\frac{1}{3}$ lbs.

$\overline{35s.}^{\,2}$: $\overline{245d.}^{\,12}$ :: $\overline{27\text{ lbs.}}^{\,2}$: $\frac{27\text{ lbs.}\times 245}{35\times 12}=9\text{ lbs.}\times 7\div 4$

$=15\frac{3}{4}$ lbs. *Ans.*

(15) 9 ho. : $10\frac{1}{2}$ ho. :: 15 da. : $\frac{10\frac{1}{2}\text{ da.}\times 5}{3}=17\frac{1}{2}$ da. *Ans.*

(16) 17 mi. 176 yds. : 75 mi. 1056 yds. :: 19 min.

10 1760 10

171 mi. : 133056 yds. :: 190 min.

$$:\frac{10\text{ min.}\times 133056}{9\times 1760}=\frac{10\text{ min.}\times 6048}{9\times 80}=84\text{ min. } \textit{Ans.}$$

(17) 59*s.* 6*d.* : 73*s.* 8*d.* :: 21*s.*

6 6

357*s.* : 442*s.* :: 21*s.* : $\frac{442s.}{17}=26s.$ *Ans.*

(18) 18*s.* $8\frac{3}{4}d.$: 19*s.* $4\frac{1}{2}d.$ :: 87*s.*

or 899*d.* : 930*d.* :: 87*s.* : $\frac{3s.\times 930}{31}=90s.$ *Ans.*

(19) $17\frac{1}{2}d.$: 21*d.* :: $12\frac{1}{2}$ lbs. : $\frac{25\text{ lbs.}\times 21}{35}=15$ lbs. ginger. *Ans.*

(20) 224 nav. : 256 nav. :: $10\frac{1}{2}$ hrs. : $\frac{21\text{ hrs.}\times 128}{224}=12$ hrs. *Ans.*

(21) 6 oz. 15 dwt. 3 grs. : 2 oz. 18 dwt. 18 grs. :: £4 5*s.* $3\frac{1}{2}d.$

or 3243 grs. : 1410 grs. :: $1023\frac{1}{2}d.$

$$:\frac{10235d.\times 141}{3243}=\frac{445d.\times 141}{141}=37s.\ 1d.\ \textit{Ans.}$$

(22) £10 7*s.* 8*d.* : £5 18*s.* 8*d.* :: 7*d.* : 4*d.* *Ans.*

also, 7*d.* : £10 7*s.* 8*d.* :: £1 : £2492÷7=£356. *Ans.*

(23) 4*s.* $10\frac{1}{2}d.$: 65*s.* :: £3 17*s.* 9*d.*

8 8

39*s.* £31 2*s.* $\times 5$

$$\frac{}{3}=£51\ 16s.\ 8d.\ \textit{Ans.}$$

(24) 77*s.* 6*d.* : 5*s.* 4*d.* :: 33 lbs. 7 oz. : $\frac{403\text{ oz.}\times 64}{930}$

=13 oz. × 64 ÷ 30=2 lbs. 3 oz. 14 dwt. 16 grs. *Ans.*

(25) 19 : 10 :: $28\frac{1}{2}$ oz. : 285 oz. ÷ 19=15 oz. *Ans.*

(26) The whole amount to be received is £15 10*s.* 6*d.*+£1 10*s.* 4*d.* +£2 15*s.*=£19 15*s.* 10*d.*

3 cwt. 2 qrs. 7 lbs. : 1 cwt. :: £19 15*s.* 10*d.*

4	4	4
14¼ qrs.	4 qrs.	79 3 4
		4
		57) 316 13 4
		£5 11*s.* 1⅓*d.* *Ans.*

(27) £3868¼ : £1 :: £902 11*s.* 10*d.*

4		4
15473		) 3610 7 4
		4*s.* 8*d.* *Ans.*

(28) 20*s.* : £2010 15*s.* 4*d.* :: 3¾*s.*

4	3	4
80	4) 6032 6 0	15
16	4) 1508 1 6	3
	£377 0*s.* 4½*d.* *Ans.*	

(29) £15960 14*s.* 7*d.* : £488 11*s.* 10½*d.* :: £5382 13*s.*

or 1532230 : 46905 :: 107653*s.*

or 218890 : 46905 :: 15379*s.*

or 3127×70 : 3127×15 :: 15379*s.*

$$: \frac{15379s. \times 3}{14} = £164\ 15s.\ 6d.\ Ans.$$

(30) 366 da. : 365 da. :: 6*s.* 4¼*d.* : $\frac{5d. \times 365}{24}$ = 6*s.* 4$\frac{1}{24}$*d.* *Ans.*

(31) 1600+490 m. : 1600 m. :: 38 da. : 29$\frac{1}{17}$ da. *Ans.*

(32) 56 da. : 38 da. :: 1400 m. : 950 m.

1400 − 950=450 m. *Ans.*

(33) 380 − 120 m. : 380 m. :: 13 da. : 19 da. *Ans.*

(34) 27+8 m. : 27 m. :: 28 da. : 21$\frac{3}{5}$ da. *Ans.*

(35) 6 m. 4 w. 5 b. : 16 m. 5 w. 13 b. :: £12 10*s.* 3*d.*

3	3	17
22 w.	53 w.	7) 212 14 3
2	2	£30 7*s.* 9*d.* *Ans.*
49 b.	119 b.	
7	17	

COMPOUND RULE OF THREE.

Ex. 29.

(1) $\left.\begin{matrix}9 : 12\text{ ac.}\\ 8 : 14\text{ hrs.}\end{matrix}\right\} :: 6\text{ m.} : \frac{6\text{ m.}\times 12\times 14}{9\times 8} = 14\text{ m. } \textit{Ans.}$

(2) $\left.\begin{matrix}5 : 10\text{ m.}\\ 10\frac{1}{2} : 14\text{ hrs.}\end{matrix}\right\} :: 6\text{ ac.} : \frac{6\text{ ac.}\times 10\times 14\times 2}{5\times 21} = 16\text{ ac. } \textit{Ans.}$

(3) $\left.\begin{matrix}10 : 8\text{ m.}\\ 9 : 5\frac{1}{4}\text{ ac.}\end{matrix}\right\} :: 15\text{ hrs.} : \frac{15\text{ hrs.}\times 2\times 21}{10\times 9} = 7\text{ hrs. } \textit{Ans.}$

(4) $\left.\begin{matrix}£48 : £63\\ £2800 : £1600\end{matrix}\right\} :: 5\text{ mo.} : \frac{5\text{ mo.}\times 63\times 16}{48\times 28} = 3\frac{3}{4}\text{ mo. } \textit{Ans.}$

(5) $\left.\begin{matrix}£100 : £265\\ 365 : 219\text{d.}\end{matrix}\right\} :: £4\frac{1}{2} : \frac{£9\times 265\times 219}{100\times 730} = £7\ 3s.\ 1\frac{1}{5}d.\ \textit{Ans.}$

(6) $\left.\begin{matrix}£34\ 11s.\ 8d. : £15\ 16s.\ 8d.\\ 4 : 7\text{ yrs.}\end{matrix}\right\} :: £4\ 9s.\ 11d.$

$$: \frac{£15\frac{5}{6}\times 7\times 1079}{8300\times 4} = \frac{95\times 7\times 13}{600\times 4} = £3\ 12s.\ 0\frac{1}{2}d.\ \textit{Ans.}$$

(7) $\left.\begin{matrix}£4\ 5s. : £3\ 17s.\ 6\frac{3}{4}d.\\ 60 : 365\text{ da.}\end{matrix}\right\} :: £100 : \frac{930\frac{3}{4}d.\times 36500}{4\frac{1}{4}\times 60}$

$$\frac{3723d.\times 3650}{17\times 6} = \frac{219d.\times 3650}{6} = £555\ 2s.\ 1d.\ \textit{Ans.}$$

(8) $\left.\begin{matrix}38\text{ lbs. }4\text{ oz.} : 22\text{ lbs. }5\text{ oz.}\\ 4s.\ 8d. : 8s.\ 2d.\end{matrix}\right\} :: 48s. : \frac{48s.\times 357\times 98}{612\times 56}$

$$\frac{4s.\times 51\times 98}{51\times 8} = 49s.\ \textit{Ans.}$$

(9) $\left.\begin{matrix}104d. : 119d.\\ 51s. : 52s.\end{matrix}\right\} :: 37\text{ lbs. }2\text{ oz.} : \frac{37\text{ lbs. }2\text{ oz.}\times 7}{2\times 3}$

$$\tfrac{1}{6} = \frac{6\text{ lbs. }3\text{ oz.}}{43\text{ lbs. }5\text{ oz. } \textit{Ans.}}$$

(10) $\left.\begin{matrix}5\frac{3}{4} : 3\frac{1}{2}\text{ lbs.}\\ 52\frac{1}{2}d. : 57\frac{1}{2}d.\end{matrix}\right\} :: 6d. : \frac{12d.\times 7\times 115}{23\times 105} = 4d.\ \textit{Ans.}$

(11) $\left.\begin{array}{r} 20 : 57 \text{ m.} \\ 5 : 6 \text{ wks.} \\ \underline{411\times21 : 2397\tfrac{1}{3}s.} \end{array}\right\} :: 10 \text{ hrs.} : \dfrac{10 \text{ hrs.}\times57\times3\times4795}{100\times411\times21}$

$$=\frac{57 \text{ hrs.}\times3\times959}{2\times411\times21}=\frac{19 \text{ hrs.}}{2}=9\tfrac{1}{2} \text{ hrs. } \textit{Ans.}$$

(12) $\left.\begin{array}{r} £243\tfrac{1}{3} : £100 \\ £3\tfrac{3}{4} : £10\tfrac{1}{4} \end{array}\right\} :: 365 \text{ da.} : \dfrac{36500 \text{ da.}\times41}{730\times5}=410 \text{ da. } \textit{Ans.}$

(13) $\left.\begin{array}{r} 3 : 4 \text{ ti.} \\ 266\times20 : 535\tfrac{1}{2}\times21 \\ 12 : 5 \text{ wks.} \\ \underline{10\tfrac{1}{2} : 8 \text{ hrs.}} \end{array}\right\} :: 38 \text{ m.} : \dfrac{38 \text{ m.}\times4\times1071\times21\times40}{3\times266\times40\times6\times21}$

$$=\frac{4 \text{ m.}\times1071}{3\times7\times6}=34 \text{ m. } \textit{Ans.}$$

(14) $\left.\begin{array}{r} 16 : 15 \text{ ho.} \\ 8 : 10\tfrac{1}{2} \text{ wks.} \\ 5 : 6d. \end{array}\right\} :: £40\ 10s.\ 8d. : \dfrac{9728d.\times15\times63}{16\times8\times5}$

$$=76d.\times3\times63=19s.\times63=£59\ 17s. \textit{ Ans.}$$

(15) $\left.\begin{array}{r} 52 : 150 \text{ ft.} \\ 27 : 39 \text{ mi.} \\ 43\tfrac{3}{4} : 33s. \end{array}\right\} :: 3\tfrac{1}{2} \text{ stone} : \dfrac{14 \text{ st.}\times150\times13\times99}{52\times27\times175}=11 \text{ st.}$ *Ans.*

(16) $\left.\begin{array}{r} 15 : 35 \text{ lab.} \\ 346\tfrac{1}{2} : 102 \text{ yds.} \\ 8\tfrac{1}{2} : 8\tfrac{1}{4} \text{ hrs.} \end{array}\right\} :: 1\tfrac{1}{2} \text{ of average} : \dfrac{3\times35\times51\times33}{15\times693\times17}=1$

$$=\text{average ability. } \textit{Ans.}$$

(17) $\left.\begin{array}{r} 126 : 117 \text{ yds.} \\ 3\tfrac{1}{4} : 3\tfrac{1}{2} \text{ ft.} \\ 4 : 4\tfrac{1}{2} \text{ ft.} \\ 10 : 11\tfrac{1}{4} \text{ hrs.} \\ 1\tfrac{1}{2} : 1 \end{array}\right\} :: 32 \text{ m.} : \dfrac{16 \text{ m.}\times117\times63\times45}{126\times13\times40\times3}=27 \text{ m. } \textit{Ans.}$

(18) $\left.\begin{array}{r} 48 : 72 \text{ m.} \\ 3 : 1\tfrac{1}{4} \\ 135 : 112 \text{ yds.} \\ 4 : 5 \text{ ft.} \\ 6\tfrac{1}{4} : 7\tfrac{1}{2} \text{ hrs.} \end{array}\right\} :: 4\tfrac{1}{2} \text{ ft.} : \dfrac{9 \text{ ft.}\times9\times5\times56\times5\times15}{48\times3\times135\times25}$

$$=56\div16=3\tfrac{1}{2} \text{ ft. } \textit{Ans.}$$

(19) 19 : $47\frac{1}{2}$ lbs. che.
27 : 18 pks. flo.
$88\frac{1}{2}$: 59 lbs. sug.
$22\frac{1}{2}$: 27 lbs. cof.
7 : 10 lbs. tea
:: 21 lbs. bac. : $\frac{21\times95\times36\times59\times10}{19\times177\times45\times7}$
=40 lbs. bacon. *Ans.*

Otherwise:—By the *Chain Rule.*

? lbs. bac.=10 lbs. tea
when 7 lbs. tea=17 lbs. cof.
$22\frac{1}{2}$ lbs. cof.=59 lbs. sug.
$88\frac{1}{2}$ lbs. sug.=18 pks. flo.
17 pks. flo.=$47\frac{1}{2}$ lbs. che.
19 lbs. che.=21 lbs. bac.

The working of the annexed statement, viz. the division of the continued product of the right hand nos. by that of the left hand nos., is evidently the same as before.

(20) 51 : 63 sides
649 : $8\frac{1}{2}$ lbs.
18 : 1180 lbs.
:: 55 lbs.
: $\frac{55\times63\times17\times590}{51\times649\times18}$
=$58\frac{1}{3}$ lbs. *Ans.*

Or, by the *Chain Rule.*

? lbs.=1 side of bacon
when 51 sides=1180 lbs. cof.
18 lbs. cof.=$8\frac{1}{2}$ lbs. tea
649 lbs. tea=63 sides bacon
1 side=55 lbs.

(21) Here, since 42 *feet* of mah. are equal in *weight* to 38 *feet* of oak, ∴ 38 *cwt.* of mah. are equal in *bulk* to 42 *cwt.* of oak; and so with the other equivalents.

cwt.	cwt.
42 oak	: 21 oak
45 P. st.	: 52 P. st.
57 mar.	: 27 mar.
28 gran.	: 35 gran.
39 iron	: 20 iron

:: 38 cwt. mah.

: $\frac{38\times21\times52\times27\times35\times20}{42\times45\times57\times28\times39}$=$6\frac{2}{3}$ cwt. *Ans.*

Or, by the *Chain Rule.*

? cwt. mah.=20 cwt. iron
when 39 „ iron=35 „ gran.
28 „ gran.=27 „ mar.
57 „ mar.=52 „ P. st.
45 „ P. st.=21 „ oak
42 „ oak =38 „ mah.

VULGAR FRACTIONS.

Answers to **Ex. 30.**

(1) $1\frac{7}{9}$; $2\frac{3}{5}$; 5; 1; $8\frac{8}{9}$; 8. (2) $\frac{10}{10}$; $\frac{64}{9}$; $\frac{56}{7}$; $\frac{324}{16}$.
(3) $\frac{35}{3}$; $\frac{15}{1}$; $\frac{107}{13}$; $\frac{120}{7}$; $\frac{5217}{20}$.

Greatest Common Measure.

Ex. 31.

(1)

24	60	2
	48	
Ans. 12	24	2

(2)

8	36	4
	32	
Ans. 4	8	2

(3)

21	34	1
13	21	1
8	13	1
5	8	1
3	5	1
2	3	1
Ans. 1	2	2

(4)

32	124	3
	96	
28	32	1
Ans. 4	28	7

(5)

48	64	1
Ans. 16	48	3

(6)

63	98	1
35	63	1
28	35	1
Ans. 7	28	4

(7)

169	208	1
39	169	4
	156	
Ans. 13	39	3

(8)

84	189	2
	168	
Ans. 21	84	4

(9)

105	245	2
	210	
Ans. 35	105	3

(10)

1008	1026	1
Ans. 18	1008	56

(11)

219	1825	8
	1752	
Ans. 73	219	3

(12)

1866	3421	1
1555	1866	1
Ans. 311	1555	5

(13)

1225	2247	1
1022	1225	1
203	1022	5
	1015	
Ans. 7	203	29

(14)

1391	2247	1
856	1391	1
535	856	1
321	535	1
214	321	1
Ans. 107	214	2

(15)

4305	52070	12
	51660	
410	4305	10
	4100	
Ans. 205	410	2

(16)

4004	5772	1
1768	4004	2
	3536	
468	1768	3
	1404	
364	468	1
104	364	3
	312	
Ans. 52	104	2

(17)

1924	200170	104
	200096	
Ans. 74	1924	26

(18)

9394	859529	91
	854854	
4675	9394	2
	9350	
44	4675	106
	4664	
Ans. 11	44	4

Least Common Multiple.

Ex. 32.

(1) 3) 12. 21
$3\times4.\ 7=84$ *Ans.*

(2) 4) 36. 20
$4\times9.\ 5=180$ *Ans.*

(3) 9) 81. 18
$9\times9.\ 2=162$ *Ans.*

(4) 3) 9. 6. 27
$3\times\ 2.\ 9=54$ *Ans.*

(5) 24. 8. 6=24 *Ans.*

(6) 8) 16. 22. 24
$8\times2.\ 11.\ 3=528$ *Ans.*

(7) 7) 24. 21. 28
$7\times24.\ 3.\ 4$
$=168$ *Ans.*

(8) 16) 12. 20. 32. 48
$16\times\ 5.\ 2.\ 3$
$=480$ *Ans.*

(9) 15) 35. 30. 84. 45
$15\times7.\ 2.\ 28.\ 3$
$=1260$ *Ans.*

(10) 12) 12. 21. 15. 18
$12\times1.\ 7.\ 5.\ 3$
$=1260$ *Ans.*

(11) 15) 25. 36. 33. 12. 45
$15\times5.\ 12.\ 11.\ 3$
$=9900$ *Ans.*

(12) 12) 7. 9. 12. 28. 48. 62
$12\times\ 3.\ \ 7.\ 4.\ 31$
$=31248$ *Ans.*

(13) 15) 52. ~~25~~. 30. 65. 75
15×52. 2. 13. 5
=101400 *Ans.*

(14) 42) 34. 28. 12. 42. 51. 63
42×~~17~~. ~~2~~. 2. 1. 17. 3
=4284 *Ans.*

(15) 13) 10. ~~9~~. 39. 4. 27. 65
2) 10. ~~3~~. 4. 27. ~~5~~
13×2×5. 2. 27
=7020 *Ans.*

(16) 3) 18. ~~8~~. 28. ~~27~~. 24. 81. 91
8) 6. 28. 8. 27. 91
3×8×~~8~~. ~~7~~. 1. 27. 91
=58968 *Ans.*

(17) 2) ~~1~~. ~~2~~. ~~3~~. ~~4~~. 5. 6. 7. 8. 9
2× 5. 3. 7. 4. 9
=7560 *Ans.*

(18) 12) ~~12~~. 14. 16. 18. 20. 22. 24
12× 7. 4. 3. 5. 11. 2
=110880 *Ans.*

REDUCTION OF A FRACTION TO LOWEST TERMS.

Ex. 33.

(1) $\frac{63}{70}=\frac{7\times9}{7\times10}=\frac{9}{10}$ *Ans.*

(2) $\frac{84}{108}=\frac{12\times7}{12\times9}=\frac{7}{9}$ *Ans.*

(3) $\frac{112}{96}=\frac{8\times14}{8\times12}=\frac{2\times7}{2\times6}=\frac{7}{6}$ *Ans.*

(4) $\frac{112}{147}=\frac{7\times16}{7\times21}=\frac{16}{21}$ *Ans.*

(5) $\frac{78}{126}=\frac{6\times13}{6\times21}=\frac{13}{21}$ *Ans.*

(6) $\frac{198}{253}=\frac{11\times18}{11\times23}=\frac{18}{23}$ *Ans.*

(7) $\frac{222}{185}=\frac{37\times6}{37\times5}=\frac{6}{5}$ *Ans.*

(8) $\frac{343}{588}=\frac{7\times49}{7\times84}=\frac{7\times7}{7\times12}=\frac{7}{12}$ *Ans.*

(9) $\frac{611}{799}=\frac{47\times13}{47\times17}=\frac{13}{17}$ *Ans.*

(10) $\frac{781}{891}=\frac{11\times71}{11\times81}=\frac{71}{81}$ *Ans.*

(11) $\frac{976}{366}=\frac{61\times16}{61\times6}=\frac{16}{6}=\frac{8}{3}$ *Ans.*

(12) $\frac{2147}{133}=\frac{19\times113}{19\times7}=\frac{113}{7}$ *Ans.*

(13) $\frac{5207}{6150}=\frac{41\times127}{41\times150}=\frac{127}{150}$ *Ans.*

(14) $\frac{347}{1326}$ *Ans.*

(15) $\frac{2370}{3397}=\frac{79\times30}{79\times43}=\frac{30}{43}$ *Ans.*

(16) $\frac{2345}{4221}=\frac{469\times5}{469\times9}=\frac{5}{9}$ *Ans.*

(17) $\frac{3551}{7685}=\frac{53\times67}{53\times145}=\frac{67}{145}$ *Ans.* (18) $\frac{119144}{1113}=\frac{53\times2248}{53\times21}=\frac{2248}{21}$ *Ans.*

(19) $\frac{1053}{8991}=\frac{81\times13}{81\times111}=\frac{13}{111}$ *Ans.* (20) $\frac{31119}{2806}=\frac{23\times1353}{23\times122}=\frac{1353}{122}$ *Ans.*

Reduction of Fractions to a Common Denominator, etc.

Ex. 34.

(1) L. C. M. of 14, 18, 21=126. Multipliers, 9, 7, 6. Hence, $\frac{5}{14}, \frac{11}{18}, \frac{10}{21}=\frac{45}{126}, \frac{77}{126}, \frac{60}{126}$ *Ans.*

(2) L. C. M. of 25, 26, 80, 39=15600. Multipliers, 624, 600, 195, 400. Hence, $\frac{12}{25}, \frac{15}{26}, \frac{1}{80}, \frac{31}{39}=\frac{7488}{15600}, \frac{9000}{15600}, \frac{195}{15600}, \frac{12400}{15600}$ *Ans.*

(3) L. C. M. of 63, 24, 49, 56=3528. Multipliers, 56, 147, 72, 63. Hence, $\frac{10}{63}, \frac{11}{24}, \frac{12}{49}, \frac{13}{56}=\frac{560}{3528}, \frac{1617}{3528}, \frac{864}{3528}, \frac{819}{3528}$ *Ans.*

(4) L. C. M. of 4, 134, 71=19028. Multipliers, 4757, 142, 268. Hence, the numerators will be 14271, 14342, 14204; and the order of magnitude is $\frac{53}{71}, \frac{3}{4}, \frac{101}{134}$ *Ans.*

(5) L. C. M. of 17, 256, 204=13056. Multipliers, 768, 51, 64. Hence, the numerators will be 3840, 3825, 3904; and the order of magnitude is $\frac{75}{256}, \frac{5}{17}, \frac{61}{204}$ *Ans.*

(6) L. C. M. of 86, 1304, 7009=56072. Multipliers, 652, 43, 8. Hence, the numerators will be 14996, 14319, 14168; and the order of magnitude is $\frac{1771}{7009}, \frac{333}{1304}, \frac{23}{86}$ *Ans.*

(7) The given fractions are as $12\times35 : 11\times25$, or as $12\times7 : 11\times5$, or as 84 : 55 *Ans.*

(8) The given fractions are as $16\times87 : 52\times27$, or as $4\times29 : 13\times9$, or as 116 : 117 *Ans.*

(9) The given fractions are $=\frac{284\times82}{17\times33\times82}$ and $\frac{655\times33}{17\times33\times82}$, or as $284\times82 : 655\times33$, or as 23288 : 21615 *Ans.*

(10) $\frac{12}{25}$ and $\frac{16}{45}=\frac{108}{225}$ and $\frac{80}{225}$; and as the G. C. M. of 108 and 80 is 4, that of the given fractions is $\frac{4}{225}$ *Ans.*

(11) $\frac{51}{5}$ and $\frac{34}{1}=\frac{51}{5}$ and $\frac{170}{5}$; G. C. M. of 51 and 170 is 17; ∴ that of the given numbers is $\frac{17}{5}$ or $3\frac{2}{5}$ *Ans.*

(12) $\frac{115}{18}$ and $\frac{161}{6}=\frac{115}{18}$ and $\frac{483}{18}$; G. C. M. of 115 and 483 is 23; ∴ that of the given quantities is $\frac{23}{18}$ or $1\frac{5}{18}$ *Ans.*

(13) $\frac{105}{8}$, $\frac{10}{1}$, and $\frac{15}{4}=\frac{105}{8}$, $\frac{80}{8}$, $\frac{30}{8}$; L. C. M. of 105, 80, and 30 is $=105\times16$; ∴ that of the given quantities is $=\frac{105\times16}{8}$ or 210 *Ans.*

(14) $\frac{28}{3}$, $\frac{32}{3}$, and $\frac{224}{9}=\frac{84}{9}$, $\frac{96}{9}$, $\frac{224}{9}$; L. C. M. of 84, 96, and 224 is 672; ∴ that of the given quantities is $\frac{672}{9}=74\frac{2}{3}$ *Ans.*

(15) $\frac{7}{20}$, $\frac{4}{35}$, and $\frac{9}{25}=\frac{245}{700}$, $\frac{80}{700}$, $\frac{252}{700}$; L. C. M. of 245, 80, and 252 is 35280; ∴ that of the given fractions is $\frac{352}{700}\frac{80}{}=50\frac{2}{5}$ *Ans.*

ADDITION OF FRACTIONS.

Ex. 35.

(1) L. C. M. of 8 and 18=72. Multipliers, 9, 4.

$$\frac{3}{8}+\frac{5}{18}=\frac{27+20}{72}=\frac{47}{72}\ \textit{Ans.}$$

(2) L. C. M. of 6 and 15=30. Multipliers, 5, 2.

$$\frac{5}{6}+\frac{1}{15}=\frac{25+2}{30}=\frac{27}{30}=\frac{9}{10}\ \textit{Ans.}$$

(3) L. C. M. of 16 and 12=48. Multipliers, 3, 4.

$$\frac{7}{16}+\frac{11}{12}=\frac{21+44}{48}=\frac{65}{48}=1\frac{17}{48}\ \textit{Ans.}$$

(4) L. C. M. of 8, 9, 10=360. Multipliers, 45, 40, 36.

$$\frac{7}{8}+\frac{8}{9}+\frac{9}{10}=\frac{315+320+324}{360}=\frac{959}{360}=2\frac{239}{360}\ \textit{Ans.}$$

(5) L. C. M. of 10, 14, 35=70. Multipliers, 7, 5, 2.

$$\frac{8}{10}+\frac{3}{14}+\frac{17}{35}=\frac{21+15+34}{70}=\frac{70}{70}=1 \text{ } \textit{Ans.}$$

(6) $\frac{2}{11}+\frac{14}{19}+1\frac{9}{11}=1+\frac{11}{11}+\frac{14}{19}=2\frac{14}{19}$ *Ans.*

(7) $3\frac{1}{2}+3\frac{3}{4}+\frac{2}{5}+\frac{1}{10}=3\frac{1}{2}+\frac{4}{10}+\frac{1}{10}+3\frac{3}{4}=3\frac{1}{2}+\frac{1}{2}+3\frac{3}{4}=7\frac{3}{4}$ *Ans.*

(8) L. C. M. of 9, 15, 12, 20=180. Multipliers, 20, 12, 15, 9.

$$\frac{8}{9}+\frac{13}{15}+\frac{11}{12}+\frac{1}{20}=\frac{160+156+165+9}{180}=\frac{49}{18}=2\tfrac{13}{18} \text{ } \textit{Ans.}$$

(9) $5\frac{3}{14}+6\frac{9}{16}+8+\frac{13}{21}=19\frac{9}{42}+\frac{26}{42}+\frac{9}{16}=19\frac{5}{6}+\frac{9}{16}=19\frac{40}{48}+\frac{27}{48}$
$=19+\frac{67}{48}=20\frac{19}{48}$ *Ans.*

(10) L. C. M. of 52, 63, 49, 39=22932. Multipliers, 441, 364, 468, 588.

$$\frac{25}{52}+\frac{31}{63}+\frac{48}{49}+\frac{25}{39}=\frac{11025+11284+22464+14700}{22932}=\frac{59473}{22932}$$
$=2\frac{13609}{22932}$ *Ans.*

(11) L. C. M. of 33, 44, 6, 11=132. Multipliers, 4, 3, 22, 12.

$$8\tfrac{10}{33}+28\tfrac{18}{44}+\frac{5}{6}+\frac{4}{11}=36+\frac{40+45+110+48}{132}=37\tfrac{37}{44} \text{ } \textit{Ans.}$$

(12) L. C. M. of 25, 45, 60, 18=900. Multipliers, 36, 20, 15, 50.

$$\frac{18}{25}+\frac{23}{45}+\frac{47}{60}+\frac{5}{18}=\frac{648+460+705+250}{900}=\frac{2063}{900}=2\tfrac{263}{900} \text{ } \textit{Ans.}$$

(13) L. C. M. of 24, 16, 20, 10=240. Multipliers, 10, 15, 12, 24.

$$68\tfrac{7}{24}+86\tfrac{9}{16}+\frac{17}{20}+84\tfrac{3}{10}=238+\frac{70+135+204+72}{240}=240\tfrac{1}{240}$$
Ans.

(14) L. C. M. of 57, 26, 76, 65, 60=14820. Multipliers, 260, 570, 195, 228, 247.

$$\therefore \frac{5}{57}+\frac{5}{26}+\frac{63}{76}+\frac{33}{65}+\frac{23}{60}=\frac{1300+2850+12285+7524+5681}{14820}$$
$=\frac{29640}{14820}=2$ *Ans.*

(15) L. C. M. of 132, 198, 144, 33=1584. Multipliers, 12, 8, 11, 48.

$$\frac{29}{132}+9\tfrac{17}{198}+\frac{55}{144}+8\tfrac{28}{33}=17+\frac{348+136+605+1344}{1584}=\frac{2433}{1584}$$

$$=\frac{811}{528}=1\tfrac{283}{528}\ \textit{Ans.}$$

(16) L. C. M. of 124, 125, 126, 155, 189=2929500. Multipliers, 23625, 23436, 23250, 18900, 15500; $\therefore \frac{71}{124}+\frac{72}{125}+\frac{73}{126}+\frac{81}{155}$

$$+\frac{61}{189}=\frac{1677375+1687392+1697250+1530900+945500}{2929500}$$

$$=\frac{7538417}{2929500}=2\tfrac{1879417}{2929500}\ \textit{Ans.}$$

(17) *Ans.* £25 8*s.* $8\frac{85}{98}$*d.*

(18) *Ans.* £31 16*s.* $6\frac{49}{180}$*d.*

(19) *Ans.* £21 10*s.* $3\frac{39}{140}$*d.*

(20) *Ans.* £24 19*s.* 3*d.*

SUBTRACTION OF FRACTIONS.

Ex. 36.

(1) $\frac{5}{6}-\frac{2}{9}=\frac{15}{18}-\frac{4}{18}=\frac{11}{18}$ *Ans.*

(2) $\frac{11}{16}-\frac{7}{12}=\frac{33}{48}-\frac{28}{48}=\frac{5}{48}$ *Ans*

(3) $\frac{9}{10}-\frac{1}{15}=\frac{27}{30}-\frac{2}{30}=\frac{25}{30}=\frac{5}{6}$ *Ans.*

(4) $\frac{7}{39}-\frac{7}{65}=\frac{(65-39)\times 7}{39\times 65}=\frac{2\times 7}{3\times 65}=\frac{14}{195}$ *Ans.*

(5) $\frac{104}{105}-\frac{23}{35}=\frac{104-69}{105}=\frac{35}{105}=\frac{1}{3}$ *Ans.*

(6) $\frac{20}{51}-\frac{14}{85}=\frac{100-42}{255}=\frac{58}{255}$ *Ans.*

(7) $17-\frac{3}{20}=16+\frac{20}{20}-\frac{3}{20}=16\frac{17}{20}$ *Ans.*

(8) $1-\frac{11}{19}=\frac{19}{19}-\frac{11}{19}=\frac{8}{19}$ *Ans.*

(5) L. C. M. of 10, 14, 35=70. Multipliers, 7, 5, 2.

$$\frac{3}{10}+\frac{3}{14}+\frac{17}{35}=\frac{21+15+34}{70}=\frac{70}{70}=1 \text{ } \textit{Ans.}$$

(6) $\frac{3}{11}+\frac{14}{19}+1\frac{9}{11}=1+\frac{11}{11}+\frac{14}{19}=2\frac{14}{19}$ *Ans.*

(7) $3\frac{1}{2}+3\frac{3}{4}+\frac{2}{5}+\frac{1}{10}=3\frac{1}{2}+\frac{4}{10}+\frac{1}{10}+3\frac{3}{4}=3\frac{1}{2}+\frac{1}{2}+3\frac{3}{4}=7\frac{3}{4}$ *Ans.*

(8) L. C. M. of 9, 15, 12, 20=180. Multipliers, 20, 12, 15, 9.

$$\frac{8}{9}+\frac{13}{15}+\frac{11}{12}+\frac{1}{20}=\frac{160+156+165+9}{180}=\frac{49}{18}=2\tfrac{13}{18} \text{ } \textit{Ans.}$$

(9) $5\frac{3}{14}+6\frac{9}{16}+8+\frac{13}{21}=19\frac{9}{42}+\frac{26}{42}+\frac{9}{16}=19\frac{5}{6}+\frac{9}{16}=19\frac{40}{48}+\frac{27}{48}$
$=19+\frac{67}{48}=20\frac{19}{48}$ *Ans.*

(10) L. C. M. of 52, 63, 49, 39=22932. Multipliers, 441, 364, 468, 588.

$$\frac{25}{52}+\frac{31}{63}+\frac{48}{49}+\frac{25}{39}=\frac{11025+11284+22464+14700}{22932}=\frac{59473}{22932}$$
$=2\frac{13609}{22932}$ *Ans.*

(11) L. C. M. of 33, 44, 6, 11=132. Multipliers, 4, 3, 22, 12.

$$8\tfrac{10}{33}+28\tfrac{15}{44}+\frac{5}{6}+\frac{4}{11}=36+\frac{40+45+110+48}{132}=37\tfrac{37}{44} \text{ } \textit{Ans.}$$

(12) L. C. M. of 25, 45, 60, 18=900. Multipliers, 36, 20, 15, 50.

$$\frac{18}{25}+\frac{23}{45}+\frac{47}{60}+\frac{5}{18}=\frac{648+460+705+250}{900}=\frac{2063}{900}=2\tfrac{263}{900} \text{ } \textit{Ans.}$$

(13) L. C. M. of 24, 16, 20, 10=240. Multipliers, 10, 15, 12, 24.

$$68\tfrac{7}{24}+86\tfrac{9}{16}+\frac{17}{20}+84\tfrac{3}{10}=238+\frac{70+135+204+72}{240}=240\tfrac{1}{240}$$
Ans.

(14) L. C. M. of 57, 26, 76, 65, 60=14820. Multipliers, 260, 570, 195, 228, 247.

$$\therefore \frac{5}{57}+\frac{5}{26}+\frac{63}{76}+\frac{33}{65}+\frac{23}{60}=\frac{1300+2850+12285+7524+5681}{14820}$$
$$=\frac{29640}{14820}=2 \text{ } \textit{Ans.}$$

(15) L. C. M. of 132, 198, 144, 33=1584. Multipliers, 12, 8, 11, 48.

$$\frac{29}{132}+9\tfrac{17}{198}+\frac{55}{144}+8\tfrac{28}{33}=17+\frac{348+136+605+1344}{1584}=\frac{2433}{1584}$$

$$=\frac{811}{528}=1\tfrac{283}{528}\ \textit{Ans.}$$

(16) L. C. M. of 124, 125, 126, 155, 189=2929500. Multipliers, 23625, 23436, 23250, 18900, 15500; $\therefore \frac{71}{124}+\frac{72}{125}+\frac{73}{126}+\frac{81}{155}$

$$+\frac{61}{189}=\frac{1677375+1687392+1697250+1530900+945500}{2929500}$$

$$=\frac{7538417}{2929500}=2\tfrac{1679417}{2929500}\ \textit{Ans.}$$

(17) *Ans.* £25 8*s.* $8\frac{85}{96}$*d.*

(18) *Ans.* £31 16*s.* $6\frac{49}{180}$*d.*

(19) *Ans.* £21 10*s.* $3\frac{39}{140}$*d.*

(20) *Ans.* £24 19*s.* 3*d.*

SUBTRACTION OF FRACTIONS.

Ex. 36.

(1) $\frac{5}{6}-\frac{2}{9}=\frac{15}{18}-\frac{4}{18}=\frac{11}{18}$ *Ans.*

(2) $\frac{11}{16}-\frac{7}{12}=\frac{33}{48}-\frac{28}{48}=\frac{5}{48}$ *Ans*

(3) $\frac{9}{10}-\frac{1}{15}=\frac{27}{30}-\frac{2}{30}=\frac{25}{30}=\frac{5}{6}$ *Ans.*

(4) $\frac{7}{39}-\frac{7}{65}=\frac{(65-39)\times 7}{39\times 65}=\frac{2\times 7}{3\times 65}=\frac{14}{195}$ *Ans.*

(5) $\frac{104}{105}-\frac{23}{35}=\frac{104-69}{105}=\frac{35}{105}=\frac{1}{3}$ *Ans.*

(6) $\frac{20}{51}-\frac{14}{85}=\frac{100-42}{255}=\frac{58}{255}$ *Ans.*

(7) $17-\frac{3}{20}=16+\frac{20}{20}-\frac{3}{20}=16\frac{17}{20}$ *Ans.*

(8) $1-\frac{11}{19}=\frac{19}{19}-\frac{11}{19}=\frac{8}{19}$ *Ans.*

(9) $300-\frac{8}{17}=299+\frac{17}{17}-\frac{8}{17}=299\frac{9}{17}$ *Ans.*

(10) $12\frac{1}{2}-\frac{1}{9}=12\frac{9}{18}-\frac{2}{18}=12\frac{7}{18}$ *Ans.*

(11) $27\frac{5}{12}-\frac{4}{15}=27\frac{25}{60}-\frac{16}{60}=27\frac{9}{60}=27\frac{3}{20}$ *Ans.*

(12) $88\frac{11}{14}-\frac{17}{35}=88\frac{55}{70}-\frac{34}{70}=88\frac{21}{70}=88\frac{3}{10}$ *Ans.*

(13) $18\frac{2}{8}-\frac{7}{8}=18\frac{16}{24}-\frac{21}{24}=18-\frac{5}{24}=17\frac{19}{24}$ *Ans.*

(14) $20\frac{1}{9}-\frac{11}{18}=20\frac{2}{18}-\frac{11}{18}=20-\frac{9}{18}=19\frac{1}{2}$ *Ans.*

(15) $4\frac{33}{34}-3\frac{50}{51}=1+\frac{99}{102}-\frac{100}{102}=1-\frac{1}{102}=\frac{101}{102}$ *Ans.*

(16) $22\frac{3}{7}-16\frac{1}{8}=6\frac{24}{56}-\frac{7}{56}=6\frac{17}{56}$ *Ans.*

(17) $16\frac{1}{8}-5\frac{3}{14}=11\frac{7}{56}-\frac{12}{56}=11-\frac{5}{56}=10\frac{51}{56}$ *Ans.*

(18) $201\frac{3}{5}-102\frac{6}{25}=99\frac{15}{25}-\frac{6}{25}=99\frac{9}{25}$ *Ans.*

(19) $1001\frac{3}{5}-23\frac{112}{175}=978\frac{15}{25}-\frac{16}{25}=978-\frac{1}{25}=977\frac{24}{25}$ *Ans.*

(20) $180\frac{1}{2004}-99\frac{25}{26052}=81+\frac{13-25}{26052}=81-\frac{1}{2171}=80\frac{2170}{2171}$ *Ans.*

(21) $101\frac{1}{561}-91\frac{3}{836}=10+\frac{76-153}{42636}=10-\frac{7}{3876}=9\frac{3869}{3876}$ *Ans.*

(22) *Ans.* £19 12*s.* $11\frac{1}{12}d.$ (23) *Ans.* 17 cwt. 3 qrs. $22\frac{7}{9}$ lbs.

(24) *Ans.* 6 ac. 2 ro. $0\frac{73}{110}$ po.

Multiplication of Fractions.

Ex. 37.

(1) $\frac{4}{9}\times\frac{5}{7}=\frac{20}{63}$ *Ans.* (2) $\frac{7}{10}\times\frac{5}{8}=\frac{7}{2}\times\frac{1}{8}=\frac{7}{16}$ *Ans.*

(3) $\frac{6}{7}\times\frac{5}{9}=\frac{2\times5}{7\times3}=\frac{10}{21}$ *Ans.* (4) $\frac{11}{12}\times\frac{8}{15}=\frac{11\times2}{3\times15}=\frac{22}{45}$ *Ans.*

(5) $\frac{8}{15}$ of $\frac{9}{10}=\frac{3}{5}\times\frac{4}{5}=\frac{12}{25}$ *Ans.* (6) $\frac{12}{1}\times\frac{7}{9}=\frac{4\times7}{3}=9\frac{1}{3}$ *Ans.*

(7) $\frac{9}{16}\times\frac{60}{1}=\frac{9\times15}{4}=33\frac{3}{4}$ *Ans.* (8) $\frac{11}{16}\times\frac{12}{13}=\frac{11\times3}{4\times13}=\frac{33}{52}$ *Ans.*

(9) $\frac{5}{2}\times\frac{18}{25}=\frac{9}{5}=1\frac{4}{5}$ *Ans.* (10) $\frac{8}{3}\times\frac{21}{4}=2\times7=14$ *Ans.*

(11) $\frac{20}{9}\times\frac{9}{1}=20$ *Ans.*

(12) $\frac{35}{6}\times\frac{9}{7}=\frac{5\times3}{2}=7\frac{1}{2}$ *Ans.*

(13) $11\frac{5}{9}\times\frac{8}{1}=\frac{920}{9}=102\frac{2}{9}$ *Ans.*

(14) $\frac{125}{11}\times\frac{77}{15}=\frac{25\times7}{3}=58\frac{1}{3}$ *Ans.*

(15) $11\frac{5}{28}\times\frac{49}{69}=\frac{5}{4}\times\frac{7}{3}=\frac{35}{12}=2\frac{11}{12}$ *Ans.*

(16) $\frac{7}{16}\times\frac{10}{27}\times\frac{22}{35}=\frac{1\times5\times11}{4\times27\times5}=\frac{11}{108}$ *Ans.*

(17) $\frac{20}{21}\times\frac{35}{36}\times\frac{9}{25}=\frac{5\times5\times9}{3\times9\times25}=\frac{1}{3}$ *Ans.*

(18) $\frac{26}{5}\times\frac{34}{39}\times\frac{32}{51}=\frac{2\times2\times32}{5\times3\times3}=2\frac{38}{45}$ *Ans.*

(19) $\frac{5}{4}\times\frac{9}{10}\times\frac{8}{9}=\frac{5\times8}{4\times10}=\frac{40}{40}=1$ *Ans.*

(20) $\frac{37}{1}\times\frac{32}{55}\times\frac{37}{48}=\frac{37\times2\times37}{55\times3}=16\frac{98}{165}$ *Ans.*

(21) $\frac{15}{2}\times\frac{57}{75}\times\frac{25}{2}=\frac{15}{2}\times\frac{19}{25}\times\frac{25}{2}=\frac{15\times19}{4}=71\frac{1}{4}$ *Ans.*

(22) $\frac{75}{26}\times\frac{30}{9}\times\frac{65}{42}\times\frac{63}{50}=\frac{3\times5\times5}{2\times2}=\frac{75}{4}=18\frac{3}{4}$ *Ans.*

(23) $\frac{4553}{6}\times\frac{843}{29}=\frac{157\times281}{2}=\frac{44117}{2}=22058\frac{1}{2}$ *Ans.*

(24) $\frac{32}{1}\times\frac{154}{9}\times\frac{6}{7}\times\frac{32}{33}\times\frac{119}{4}\times\frac{83}{85}=\frac{32\times14\times16\times83}{3\times3\times5}=1322044\frac{4}{45}$ *Ans.*

(25) $\frac{18277}{57}\times\frac{38}{1}=\frac{18277\times2}{3}=12184\frac{2}{3}$ *Ans.*

DIVISION OF FRACTIONS.

Ex. 38.

(1) $\frac{5}{8}\div\frac{4}{5}=\frac{5}{8}\times\frac{5}{4}=\frac{25}{32}=1\frac{13}{32}$ *Ans.*

(2) $\frac{3}{8}\div\frac{5}{6}=\frac{3}{8}\times\frac{6}{5}=\frac{3\times3}{4\times5}=\frac{9}{20}$ *Ans.*

(3) $\frac{14}{15}+\frac{21}{25}=\frac{14}{15}\times\frac{25}{21}=\frac{2\times5}{3\times3}=\frac{10}{9}=1\frac{1}{9}$ *Ans.*

(4) $\frac{8}{9}\div6=\frac{8}{54}=\frac{4}{27}$ *Ans.* (5) $\frac{25}{4}\div\frac{5}{6}=\frac{25}{4}\times\frac{6}{5}=7\frac{1}{2}$ *Ans.*

(6) $\frac{21}{4}\div14=\frac{21}{56}=\frac{3}{8}$ *Ans.* (7) $\frac{14}{1}\div\frac{35}{4}=\frac{14}{1}\times\frac{4}{35}=1\frac{3}{5}$ *Ans.*

(8) $18\div\frac{12}{13}=\frac{18}{1}\times\frac{13}{12}=\frac{3\times13}{2}=\frac{39}{2}=19\frac{1}{2}$ *Ans.*

(9) $\frac{6}{1}\times\frac{8}{9}\times\frac{3}{7}\div\frac{11}{24}=\frac{6}{1}\times\frac{8}{9}\times\frac{3}{7}\times\frac{24}{11}=\frac{16\times24}{7\times11}=4\frac{76}{77}$ *Ans.*

(10) $\frac{21}{1}\times\frac{7}{12}\div(\frac{33}{4}\times\frac{8}{11})=\frac{21}{1}\times\frac{7}{12}\times\frac{4}{33}\times\frac{11}{8}=\frac{49}{24}=2\frac{1}{24}$ *Ans.*

(11) $\frac{16}{5}\div(\frac{22}{7}\times\frac{3}{11}\times\frac{7}{8})=\frac{16}{5}\times\frac{7}{22}\times\frac{11}{3}\times\frac{8}{7}=\frac{64}{15}=4\frac{4}{15}$ *Ans.*

(12) $\frac{11}{12}\times\frac{13}{5}\times\frac{23}{28}\div(\frac{13}{2}\times\frac{46}{49})=\frac{11}{12}\times\frac{13}{5}\times\frac{23}{28}\times\frac{2}{13}\times\frac{49}{46}=\frac{77}{240}$ *Ans.*

(13) $\frac{17}{5}\times\frac{10}{20}\div(\frac{133}{1}\times\frac{34}{35}\times\frac{11}{10})=\frac{17}{5}\times\frac{10}{20}\times\frac{1}{133}\times\frac{35}{34}\times\frac{10}{11}=\frac{1}{44}$ *Ans.*

(14) $20\div22\frac{1}{2}=\frac{40}{45}=\frac{8}{9}$ *Ans.* (15) $3\frac{4}{7}\div10=\frac{25}{10\times7}=\frac{5}{14}$ *Ans.*

(16) $6\frac{1}{3}\div8\frac{4}{9}=\frac{19\times3}{76}=\frac{3}{4}$ *Ans.* (17) $4\frac{7}{12}\div6\frac{3}{16}=\frac{55\times16}{99\times12}=\frac{20}{27}$ *Ans.*

(18) $\frac{7}{8}\div\frac{8}{5}=\frac{7}{8}\times\frac{5}{8}=\frac{35}{64}$ *Ans.*

(19) $\frac{28\times10}{21\times25}$ of $\frac{5\times9}{14\times7}\div\frac{8\times6}{49}=\frac{5\times9}{14\times7}\times\frac{4\times2}{3\times5}\times\frac{49}{48}=\frac{1}{4}$ *Ans.*

(20) $\frac{182\times2}{73\times5}\times\frac{17\times3}{52}\div(\frac{68}{73}\times\frac{2}{9})=\frac{7}{73\times5}\times\frac{17\times3}{1}\times\frac{73}{68}\times\frac{9}{2}=4\frac{29}{40}$ *Ans.*

Supplement to Multiplication and Division of Fractions.

Ex. 39.

(1) $9)975\frac{3}{14}$ *Ans.* $108\frac{5}{14}$

(2) $7)2794\frac{3}{5}$ *Ans.* $399\frac{8}{35}$

(3) $11)5489\frac{12}{13}$ *Ans.* $499\frac{12}{143}$

(4) $12)2679\frac{7}{19}$ *Ans.* $223\frac{16}{57}$

(5) $12)473\frac{101}{119}$ *Ans.* $39\frac{59}{119}$

(6) $16)5109\frac{11}{24}$ *Ans.* $319\frac{131}{384}$

(7) 7) $6007\frac{13}{15}$
4) $858\frac{4}{15}$
Ans. $214\frac{17}{30}$

(8) 11) $4222\frac{1}{6}$
8) $383\frac{5}{6}$
Ans. $47\frac{47}{48}$

(9) 31) $220\frac{9}{28}$
3) $7\frac{3}{28}$
Ans. $2\frac{31}{84}$

(10) $7365\frac{13}{27}$
3
$22096\frac{4}{9}$
5
Ans. $110482\frac{2}{9}$

(11) $495\frac{3}{49}$
7
$3465\frac{3}{7}$
4
Ans. $13861\frac{5}{7}$

(12) $1507\frac{14}{65}$
8
$12057\frac{47}{65}$
8
Ans. $96461\frac{51}{65}$

(13) $269\frac{3}{26} \times \frac{65}{8}$
13
$3498\frac{1}{2}$
5
8) $17492\frac{1}{2}$
Ans. $2186\frac{9}{16}$

(14) $1440\frac{17}{20} \times \frac{116}{3}$
4
$5763\frac{2}{5}$
29
13) $167138\frac{2}{5}$
Ans. $12856\frac{53}{65}$

Otherwise.
$1440\frac{17}{20} \times (9 - \frac{1}{13})$
9
$12967\frac{13}{20}$
$110\frac{217}{260}$
$12856\frac{53}{65}$

(15) $783\frac{19}{108} \times \frac{343}{24}$
7
$5482\frac{4}{15}$
7
$38375\frac{13}{15}$
7
24) $268631\frac{1}{15}$
Ans. $11192\frac{173}{180}$

Otherwise.
$783\frac{19}{108} \times 14\frac{7}{24}$
7
24) $5482\frac{4}{15} \times 2$
$228\frac{77}{180}$
$10964\frac{8}{15}$
$11192\frac{173}{180}$

(16) $18\frac{3}{8}$ $4567\frac{8}{9}$ / 8
147) $36543\frac{1}{9}$
Ans. $248\frac{16}{27}$

(17) $16\frac{25}{28}$ $7017\frac{13}{36}$ / 28
473) $196486\frac{1}{9}$
Ans. $415\frac{40}{99}$

(18) $30\frac{18}{65}$ $968\frac{18}{365}$ / 65
1968) $62923\frac{15}{73}$
Ans. $31\frac{1705}{1752}$

(19) $\frac{21\frac{3}{7}+4\frac{1}{2}}{24\frac{1}{8}-7\frac{3}{7}} = \frac{150+31\frac{1}{2}}{168\frac{7}{8}-52} = \frac{181\frac{1}{2}}{116\frac{7}{8}} = \frac{1452}{935} = \frac{132}{85} = 1\frac{47}{85}$ *Ans.*

(20) $\frac{5\frac{13}{15}+\frac{2}{9} \text{ of } 17\frac{1}{3}}{\frac{3}{10} \text{ of } 63+5\frac{7}{10}} = \frac{58\frac{2}{3}+\frac{2}{9} \text{ of } 173\frac{1}{3}}{63\times 3+57} = \frac{176\times 9+520\times 2}{246\times 27} = \frac{2624}{246\times 27}$
$= \frac{32}{3\times 27} = \frac{32}{81}$ *Ans.*

(21) $\frac{7}{16}$ of $5\frac{1}{4}$ of $12 \div \frac{2}{3}(8\frac{2}{3}-1\frac{1}{5}) = \frac{63\times7\times9}{32\times(26-3\frac{3}{5})} = \frac{63\times7\times9\times5}{32\times112} = \frac{2835}{512} = 5\frac{275}{512}$ *Ans.*

(22) $\frac{4\frac{1}{2}-9\frac{1}{2}+\frac{4}{7}(18\frac{2}{5}+4\frac{7}{9})}{(9\frac{1}{4}-\frac{2}{9})\times(7\frac{3}{7}+\frac{12}{13})} = \frac{\frac{9}{2}-\frac{19}{2}\times\frac{7}{4}\times\frac{40}{921}}{\frac{325}{36}\times\frac{760}{91}} = \left(\frac{9}{2}-\frac{5}{7}\right)\div\left(\frac{25}{9}\times\frac{190}{7}\right)$
$= \frac{53}{14}\times\frac{63}{4750} = \frac{477}{9500}$ *Ans.*

(23) $\frac{10\frac{1}{2}+5\frac{1}{8}(4\frac{1}{4}-3\frac{1}{6})}{\frac{1}{3}-\frac{1}{4}\{\frac{1}{5}-\frac{1}{6}(\frac{1}{7}-\frac{1}{8})\}} = \frac{\frac{21}{2}+\frac{16}{8}\text{ of }\frac{21}{20}}{\frac{1}{3}-\frac{1}{4}\text{ of }(\frac{1}{5}-\frac{1}{336})} = \left(\frac{21}{2}+\frac{28}{5}\right)\div\frac{1909}{6720}$
$= \frac{161}{10}\times\frac{6720}{1909} = \frac{4704}{83} = 56\frac{56}{83}$ *Ans.*

(24) $\frac{8\frac{1}{3}}{11\frac{3}{4}}$ of $\frac{15\frac{1}{3}}{23\frac{3}{4}}$ of $\frac{29\frac{1}{8}}{32\frac{1}{6}}$ of $\left(\frac{3\frac{7}{8}}{3\frac{2}{7}}-\frac{7}{5}\text{ of }\frac{2\frac{1}{2}}{4\frac{1}{2}}\right)\div\{9-8\div7(6-5\div4)\}$
$= \frac{25\times4}{47\times3}\times\frac{46\times4}{95\times3}\times\frac{233\times6}{193\times8}\times\left(\frac{31\times7}{23\times8}-\frac{25}{63}\right)\div\left\{9-\frac{32}{7(24-5)}\right\}$
$= \frac{5\times4}{47\times3}\times\frac{46}{19}\times\frac{233}{193}\times\frac{9071}{46\times4\times63}\times\frac{133}{1165} = \frac{1}{27}$ *Ans.*

Ex. 40.

(1) $\frac{4}{9}$ of £1 $= \frac{4}{9}$ of 20*s.* $= 80s. \div 9 = 8s.\ 10\frac{2}{3}d.$ *Ans.*
$\frac{5}{8}$ of 1 yd. $= \frac{1}{8}$ of 5 yds. $= 15$ ft. $\div 8 = 1$ ft. $10\frac{1}{2}$ in. *Ans.*

(2)

	ac.	ro.	po.	
	2	3	15	$\times 1\frac{11}{15}$
			11	
13)	31	1	5	
	2	1	25	
	5	1	0	*Ans.*

(3)

	£	*s.*	*d.*	
	12	15	$8\frac{1}{2}$	$\times\frac{17}{32}$
			17	
32)	217	7	$0\frac{1}{2}$	
	6	15	$10\frac{9}{64}$	*Ans.*

(4)

	£	*s.*	*d.*	
	49	15	3	$\times\frac{8}{81}$
			8	
81)	398	2	0	
	4	18	$3\frac{5}{9}$	*Ans.*

(5)

	mi.	fur.	po.	
	3	5	$21\frac{1}{2}$	$\times 6\frac{6}{7}$
			6	
7)	22	1	9	
	3	1	$12\frac{5}{7}$	
	25	2	$21\frac{5}{7}$	*Ans.*

(6)
gal. qts. pts.
23 3 $2\frac{25}{26}\times\frac{169}{5}$
13
313 2 $0\frac{1}{2}$
13
5) 4076 1 $0\frac{1}{2}$
815 1 $0\frac{1}{10}$ *Ans.*

(7)
£ s. d.
8 7 $11\frac{8}{15}\times35\frac{5}{12}$
5
12) 41 19 $9\frac{2}{3}\times7$
3 9 $11\frac{29}{36}$
293 18 $7\frac{2}{3}$
297 8 $7\frac{17}{36}$ *Ans.*

(8)
yrs. da. hrs.
13 37 $17\frac{7}{8}\times\frac{149}{14}$
149
14) 1952 148 $23\frac{3}{8}$
139 167 $1\frac{75}{112}$ *Ans.*

(9)
£ s. d.
5 16 $9\frac{3}{4}\div\frac{5}{11}$
11
5) 64 4 $11\frac{1}{4}$
12 16 $11\frac{17}{20}$ *Ans.*

(10)
sc. ro. po.
$1\frac{5}{13}$) 11 2 $12\frac{6}{7}$
13 13
18) 150 2 $7\frac{1}{7}$
8 1 $18\frac{11}{63}$ *Ans.*

(11)
£ s. d.
$9\frac{1}{10}$) 370 9 $3\frac{11}{27}$
10 10
91) 3704 12 $10\frac{2}{27}$
40 14 $2\frac{170}{351}$ *Ans.*

Otherwise.

(12)
lbs. oz. dwt.
3 10 $17\frac{16}{55}\div\frac{20}{21}$
7
27 4 $2\frac{1}{5}$
3
20) 82 0 $6\frac{3}{5}$
4 1 $4\frac{33}{100}$ *Ans.*

lbs. oz. dwt.
20) 3 10 $17\frac{16}{55}\times1\frac{1}{20}$
0 2 $6\frac{611}{700}$
4 1 $4\frac{33}{100}$

(13)
£ s. d.
$109\frac{1}{8}$) 16 0 $3\frac{5}{8}$
8 8
873) 128 2 5
0 2 $11\frac{2}{9}$ *Ans.*

(14)
qu. bu. pk.
48 5 $0\frac{17}{81}\div\frac{233}{240}$
240
233) 11671 4 $2\frac{10}{27}$
50 0 $2\frac{26}{27}$ *Ans.*

(15)
fur. po. yds. ft.
6 17 4 $2\frac{2}{5}$
or, 6 17 $4\frac{4}{5}$
$20\frac{1}{7}$
0 36 $4\frac{43}{70}$
128 37 $2\frac{1}{2}$
129 34 $1\frac{43}{70}$
=129 34 .1 $1\frac{59}{70}$ *Ans.*

(16)
ro. po. sq. yds. ft.
2 39 30 $2\frac{1}{5}\times6\frac{7}{8}$
or, 2 39 $30\frac{17}{72}\times\frac{55}{8}$
55
8) 164 39 $29\frac{25}{72}$
20 24 $30\frac{89}{576}$
or, 5 24 30 $1\frac{25}{64}$ *Ans.*

Reduction of Concrete Fractions.

Ex. 41.

(1) $\frac{1}{8}d. \div 12d. = \frac{1}{96}s.$ *Ans.* $£\frac{21}{20} \times \frac{7}{12} = £\frac{49}{80}$ *Ans.*

(2) $\frac{33}{35}$ yd. $\div 1760$ yds. $= \frac{3}{5600}$ mi. *Ans.*
$30\frac{1}{4}$ sq. yds. $\times 40 \times 4 \times \frac{5}{11} = 2200$ sq. yds. *Ans.*

(3) $\frac{20}{17}$ *cr.* $\div 8$ *crs.* $= £\frac{5}{34}$ *Ans.* $\frac{12}{5}f. \div (4f. \times 60) = \frac{1}{100}$ *cr. Ans.*

(4) $\frac{27}{21}$ *guin.* $\times \frac{13}{18} = \frac{13}{14}$ *guin. Ans.* $\frac{42}{5}$ *hf. cr.* $\times \frac{5}{18} = \frac{7}{3}$ *hf. cr. Ans.*

(5) $\frac{24}{25}$ dwt. $\div (20$ dwt. $\times 12) = \frac{1}{250}$ lb. *Ans.*
112 lbs. $\times 20 \times \frac{1}{350} = 6\frac{2}{5}$ lbs. *Ans.*

(6) $\frac{15}{26}$ of $\frac{10}{27}$ *moid.* $= \frac{25}{117}$ *moid. Ans.* $\frac{10}{9}$ of $\frac{21}{10}$ *hf. sov.* $= \frac{7}{3}$ *hf. sov. Ans.*

(7) $\frac{14}{27}$ oz. $\div (16$ oz. $\times 112) = \frac{1}{3456}$ cwt. *Ans.*
24 grs. $\times 20 \times 12 \times \frac{17}{96} = 1020$ grs. *Ans.*

(8) $\frac{7000}{5760}$ lb. Tr. $\times \frac{3}{80} = \frac{35}{768}$ lb. Tr. *Ans.*
$\frac{5760}{7000}$ of 16 oz. Av. $\times \frac{7}{11} = 8\frac{104}{275}$ oz. Av. *Ans.*

(9) $\frac{35}{81}$ of $20s. \div 8\frac{3}{4}s. = \frac{20 \times 35}{81} \times \frac{4}{35} = \frac{80}{81}$ *Ans.*
$\frac{3}{8}$ of $5s. \div 5\frac{1}{4}s. = \frac{15}{8} \div \frac{21}{4} = 15 \div 42 = \frac{5}{14}$ *Ans.*

(10) $\frac{11}{7}$ of $2\frac{1}{2}s. \div 50s. = \frac{11}{14}$ of $\frac{5}{50} = \frac{11}{140}$ *Ans.*
$\frac{7}{8}$ of $13\frac{1}{2}s. \div 18s.$ $9\frac{3}{4}d. = \frac{7}{16}$ of $\frac{27 \times 12}{225\frac{3}{4}} = \frac{7 \times 27 \times 3}{903} = \frac{27}{43}$ *Ans.*

(11) $\frac{31}{88}$ of 220 yds. $\div 4950$ yds. $= \frac{31}{88}$ of $\frac{2}{45} = \frac{31}{855}$ *Ans.*
$\frac{49}{20}$ mi. $\div 2$ mi. 330 yds. $= \frac{49}{20} \div 2\frac{3}{16} = \frac{49}{20} \times \frac{16}{35} = \frac{28}{25}$ *Ans.*

(12) $\frac{74}{45}$ Eng. ell $\div 5\frac{1}{2}$ yds. $= \frac{74}{45}$ of $\frac{5}{4}$ yd. $\div \frac{11}{2}$ yd. $= \frac{74 \times 2}{36 \times 11} = \frac{37}{99}$ *Ans.*

$\frac{23}{10}$ yd. $\div 5$ Eng. ells 5 in. $= \frac{23}{10}$ of 36 in. $\div 5\frac{1}{5}$ times 45 in.

$= \frac{36 \times 23}{10 \times 46 \times 5} = \frac{9}{25}$ *Ans.*

(13) £3 10*s.* 6*d.* + £6 = 70½*s.* + 120*s.* = $\frac{141}{240} = \frac{47}{80}$ *Ans.*
18*s.* 5*d.* + 15*s.* 7*d.* = 221*d.* + 187*d.* = $\frac{13}{11}$ *Ans.*

(14) 19*d.* + 85½*d.* = $\frac{38}{171} = \frac{2}{9}$ *Ans.*
$\frac{3}{7}$ of 6½*s.* + 21*s.* = $\frac{39}{14} \times \frac{1}{21} = \frac{13}{98}$ *Ans.*

(15) 3 min. 37 sec. + 11 wks. 5 da. = 217 sec. + (82 × 24 × 3600 sec.)
= $\frac{217}{7084800}$ *Ans.*
$43\frac{4}{5}$ da. + $3\frac{1}{2}$ yrs. = $\frac{219}{5}$ da. + $\frac{7}{2}$ of 365 da. = $\frac{219 \times 2}{365 \times 35} = \frac{6}{175}$ *Ans.*

(16) 7 fur. 39 po. + 2 po. 4½ yds. = 319 po. + $2\frac{9}{11}$ po. = $\frac{3509}{31}$ *Ans.*
$\frac{11}{700}$ mi. + 327¼ in. = $\frac{11}{700}$ of 1760 yds. + $\frac{327\frac{1}{4}}{36}$ yd.
= $\frac{1760 \times 11 \times 36}{1309 \times 175} = \frac{352 \times 36}{119 \times 35} = \frac{12672}{4165}$ *Ans.*

Ex. 42.

(1) £$\frac{3}{16}$ = £3 ÷ 16 = 60*s.* ÷ 16 = 3*s.* 9*d.* *Ans.*
$\frac{5}{18}$*s.* = 5*s.* ÷ 18 = 60*d.* ÷ 18 = $3\frac{1}{3}$*d.* *Ans.*
$\frac{3}{14}$ *guin.* = 3 *guin.* ÷ 14 = 63*s.* ÷ 14 = 9*s.* ÷ 2 = 4*s.* 6*d.* *Ans.*
£$\frac{5}{6}$ = £5 ÷ 6 = 100*s.* ÷ 6 = 16*s.* 8*d.* *Ans.*

(2) £$\frac{31}{36}$ = £31 ÷ 36 = 17*s.* $2\frac{2}{3}$*d.* *Ans.*
$\frac{21}{40}$ *hf. cr.* = 21 *hf. crs.* ÷ 40 = 30*d.* × 21 ÷ 40 = $15\frac{3}{4}$*d.* *Ans.*
$5\frac{6}{11}$*s.* = 5*s.* + $\frac{1}{11}$ of 6*s.* = 5*s.* $6\frac{6}{11}$*d.* *Ans.*
$\frac{13}{21}$ *moid.* = $\frac{1}{21}$ of 13 *moid.* = 27*s.* × 13 ÷ 21 = 16*s.* $8\frac{4}{7}$*d.* *Ans.*

(3) $\frac{7}{32}$ cwt. = 7 cwt. ÷ 32 = 112 lbs. × 7 ÷ 32 = 7 lbs. × 7 ÷ 2 = $24\frac{1}{2}$ lbs. *Ans.*
$\frac{15}{16}$ dwt. = 15 dwt. ÷ 16 = 24 grs. × 15 ÷ 16 = $22\frac{1}{2}$ grs. *Ans.*
$2\frac{1}{6}$ gal. = 2 gal. + 4 qts. ÷ 6 = 2 gal. + 4 pts. ÷ 3 = 2 gal. 1⅓ pt. *Ans.*

(4) $\frac{17}{21}$ ton = 17 t. ÷ 21 = 340 cwt. ÷ 21 = 16 cwt. $21\frac{1}{3}$ lbs. *Ans.*
$\frac{47}{54}$ da. = 47 da. ÷ 54 = 24 hrs. × 47 ÷ 54 = 188 hrs. ÷ 9
= 20 hrs. 53 min. 20 sec. *Ans.*
$11\frac{5}{8}$ sq. yds. = 11 sq. yds. + 5 sq. yds. ÷ 8 = 11 sq. yds. + 45 ft. ÷ 8
= 11 sq. yds. 5 ft. 90 in. *Ans.*

(5) $\frac{11}{18}$ cub. yd.=11 c. yds.÷18=27 c. ft.×11÷18=33 c. ft.÷2
=16$\frac{1}{2}$ c. ft. *Ans.*

$\frac{5}{11}$ mi.=5 mi.÷11=1760 yds.×5÷11=160 yds.×5=800 yds. *Ans.*

3$\frac{8}{9}$ wks.=3 wks.+8 wks.÷9=3 wks.+56 da.÷9
=3 wks. 6 da. 5 hrs. 20 min. *Ans.*

(6) $\frac{22}{25}$ Eng. ell=1$\frac{1}{4}$ yd.×22÷25=$\frac{1}{4}$ yd.×22÷5=5 yds. 2 qrs.÷5
=1 yd. 1$\frac{3}{8}$ na. *Ans.*

3$\frac{2}{9}$ sq. po.=3 sq. po.+2 po.÷9=3 sq. po.+60$\frac{1}{9}$ yds.÷9
=3 sq. po. 6$\frac{13}{18}$ yds.=3 sq. po. 6 yds. 6$\frac{1}{2}$ ft. *Ans.*

$\frac{13}{20}$ leap yr.=366 da.×13÷20=237 da. 21 hrs. 36 min. *Ans.*

(7) $\frac{5}{8}$ *guin.*=21*s.*×5÷8=13*s.* 1$\frac{1}{2}$*d.*;
£$\frac{3}{64}$=20*s.*×3÷64=180*d.*÷16=11$\frac{1}{4}$*d.*;
$\frac{15}{16}$*s.*=12*d.*×15÷16=45*d.*÷4=11$\frac{1}{4}$*d.*;
hence, 13*s.* 1$\frac{1}{2}$*d.*+11$\frac{1}{4}$*d.*+11$\frac{1}{4}$*d.*=15*s.* *Ans.*

(8) $\frac{17}{56}$ *hf. guin.*=126*d.*×17÷56=9*d.*×17÷4=3*s.* 2$\frac{1}{4}$*d.*;
$\frac{17}{36}$ *moid.*=27*s.*×17÷36=51*s.*÷4=12*s.* 9*d.*;
17$\frac{17}{18}$ *hf. crs.*=£2 2*s.* 6*d.*+17 *hf. crs.*÷18=£2 2*s.* 6*d.*+85*d.*÷3
=£2 4*s.* 10$\frac{1}{3}$*d.*;
hence, 3*s.* 2$\frac{1}{4}$*d.*+12*s.* 9*d.*+£2 4 10$\frac{1}{3}$*d.*=£3 0*s.* 9$\frac{7}{12}$*d.* *Ans.*

(9)

	£	*s.*	*d.*
3$\frac{13}{20}$ *guin.*=£3 3*s.*+13 *guin.*÷20=	+3	16	7$\frac{4}{5}$
25$\frac{14}{33}$*s.*=25*s.*+12*d.*×14÷33	+1	5	5$\frac{1}{11}$
1$\frac{6}{15}$ *moid.*=27*s.*×23÷15	−2	1	4$\frac{4}{5}$
£1 15*s.* 3*d.*+£1 5*s.* 5$\frac{1}{11}$*d.*	3	0	8$\frac{1}{11}$ *Ans.*

(10) £3$\frac{11}{54}$=£3 4*s.* 0$\frac{8}{9}$*d.* Also, $\frac{11}{24}$ of $\left(\frac{14}{15}s.-\frac{7}{165}\,guin.\right)$
=$\frac{11}{24}$ of $\left(\frac{154s.}{165}-\frac{147s.}{165}\right)$=$\frac{7}{165}d.\times\frac{11}{2}=\frac{7}{30}d.$; hence,
£3 4*s.* 0$\frac{8}{9}$*d.*+$\frac{7}{30}$*d.*=£3 4*s.* 1$\frac{11}{90}$*d.* *Ans.*

(11) $\frac{7}{24}$ cwt.−$\frac{1}{64}$ ton+$\frac{1}{12}$ qr.=$\frac{7}{24}$ cwt.−$\frac{5}{16}$ cwt.+$\frac{1}{48}$ cwt.
=$\frac{5}{16}$ cwt.−$\frac{5}{16}$ cwt.=0 *Ans.*

(12) $1\frac{7}{12}$ mile $=$ mi. 1, fur. 4, po. 26, yds. $3\frac{3}{3}$

$\frac{4}{9}$ po. $+1\frac{1}{6}$ yd. $=2\frac{4}{9}$ yds. $+1\frac{1}{6}$ yd. $=$ 0 0 0 $3\frac{11}{18}$

1 4 27 $1\frac{7}{9}$

$\frac{3}{8}$ fur. $=\frac{3}{8}$ of 40 poles $=$ 0 0 15 0

Ans. 1 4 12 $1\frac{7}{9}$

(13) $\frac{187}{487}$ of $365\frac{1}{4}$ da. $=\frac{561}{4}$ da. $=140$ da. 6 hrs.

$\frac{101}{250}$ min. $=\frac{101}{250}$ of 60 sec. $=24\frac{6}{25}$ sec.; to which we must add $5\frac{16}{35}$ da., or 5 da. 10 hrs. 58 min. $17\frac{1}{7}$ sec.;

	da.	hrs.	min.	sec.
hence, from	140	6	0	0
we are to subtract	5	10	58	$41\frac{67}{175}$
Ans.	134	19	1	$18\frac{108}{175}$

(14) The given expression is equivalent to

$$9\{\tfrac{1}{28}\text{ ac.} - \tfrac{1}{16}(\tfrac{1}{24}\text{ ro.} - \tfrac{4}{25}\text{ po.}) - \tfrac{1}{35}\text{ sq. yd.}\}$$
$$= 9\{\tfrac{1}{28}\text{ ac.} - \tfrac{1}{16}(\tfrac{5}{3}\text{ po.} - \tfrac{4}{25}\text{ po.}) - \tfrac{1}{35}\text{ sq. yd.}\}$$
$$= 9(\tfrac{1}{28}\text{ ac.} - \tfrac{1}{16}\text{ of }\tfrac{113}{75}\text{ po.} - \tfrac{1}{35}\text{ sq. yd.})$$

	ro.	po.	yds.	ft.	in.
$\frac{1}{28}$ ac. $=\frac{1}{28}$ of 160 po. $=$	0	5	21	5	$66\frac{6}{7}$
$\frac{1}{16}$ of $\frac{113}{75}$ po. $=$	0	0	2	7	$91\frac{71}{100}$
$\frac{1}{35}$ sq. yd. $=$	0	0	0	0	$37\frac{1}{35}$
	0	0	2	7	$128\frac{517}{700}$
	0	5	18	6	$82\frac{83}{700}$
					9
	1	10	$16\frac{3}{4}$	5	$19\frac{47}{700}$
$\frac{3}{4}$ yd. $=$				6	108
Ans.	1	10	17	2	$127\frac{47}{700}$

DECIMAL FRACTIONS.

Answers to **Ex. 43.**

(1) $\frac{7}{10}$, $\frac{309}{1000}$, $\frac{39}{100}$, $2\frac{51}{100}$; $15\frac{1}{5}$, $\frac{73}{200}$, $3\frac{13}{20}$, $\frac{9}{100}$; $\frac{19}{625}$, $11\frac{3}{4}$, $\frac{1}{4}$, $6\frac{1}{2}$; $\frac{1}{1000}$, $\frac{9}{10000}$, $4\frac{2}{25}$, $20\frac{1}{200}$; $201\frac{2}{5}$, $\frac{3}{40000}$, $144\frac{1}{312500}$, $1\frac{733}{3125}$.

(2) ·8, ·24, ·3, 1·2, ·327; ·037, 15·6, 3·13, ·09185; ·221, 36, 19·905, ·0000017.

(3) 23·456 and 2345·6; 4·75 and 47·5; 31081 and 3108100; ·01 and 10; 3·575 and 357500.

(4) 607·02 and 6·0702; 6·0702 and ·060702; ·00215 and ·0000215; 365·4 and ·3654; ·00001 and ·000000001.

Addition and Subtraction of Decimals.

Answers to **Ex. 44.**

(1) 7·0317. (2) 439·3284. (3) 156·32363.
(4) 820. (5) 9·895; 4·99. (6) 96·9945; ·290737.
(7) 75·0665. (8) 30·280965.

Multiplication of Decimals.

Ex. 45.

(1)
$$\begin{array}{r} \cdot 59 \\ \cdot 7 \\ \hline \cdot 413 \end{array}$$ *Ans.*

$$\begin{array}{r} 5{\cdot}99 \times {\cdot}17 \\ 4193 \\ \hline 1{\cdot}0183 \end{array}$$ *Ans.*

(2)
$$\begin{array}{r} 3{\cdot}406 \\ 5{\cdot}4 \\ \hline 13624 \\ 17030 \\ \hline 18{\cdot}3924 \end{array}$$ *Ans.*

$$\begin{array}{r} \cdot 379 \\ 1{\cdot}84 \\ \hline 1516 \\ 3032 \\ 379 \\ \hline \cdot 69736 \end{array}$$ *Ans.*

(3)
2796
·85
13980
22368
2376·60 *Ans.*

·4321
900
388·8900 *Ans.*

(4)
487·5
·0001996
29250
43875
43875
4875
·09730500 *Ans.*

·0365
·0064
1460
2190
·00023360 *Ans.*

(5)
·19734
7250
986700
39468
138138
1430·71500 *Ans.*

1·00378
·0378
803024
702646
301134
·037942884 *Ans.*

(6)
12·3
1·23
369
1476
15·129
·123
45387
181548
1·860867 *Ans.*

189
·189
1701
3402
35·721
1·89
321489
642978
67·51269 *Ans.*

(7)
·15×80= 12
3·075
36·900 *Ans.*

·475×·004=·0019
895
8055
895
1·7005 *Ans.*

(8)
·89758
125
448790
1077096
112·19750

112·1975
·0035147
7853825
15707650
39269125
·39434055325 *Ans.*

250000
·008
2000·000
·019
38·000 *Ans.*

Division of Decimals.

Ex. 46.

(1) 7) 407·281 — 58·183 *Ans.*

(2) 11) 5·8707 — ·5337 *Ans.*

(3) 4) 7·00 — 1·75 *Ans.*

9) 34·0056 — 3·7784 *Ans.*

18) ·587070 — ·032615 *Ans.*

12) 1207·80 — 100·65 *Ans.*

(4) 16) 15·0000 — ·9375 *Ans.*

32) 1·00000 — ·03125 *Ans.*

48) ·1500 — ·003125 *Ans.*

(5) 281·5515 ÷ 8·9
= 2815·515 ÷ 89
= 31·635 *Ans.*

352·872 ÷ ·87
= 35287·2 ÷ 87
= 405·6 *Ans.*

(6) ·014586 ÷ ·748
= 14·586 ÷ 748
= ·0195 *Ans.*

·000273 ÷ ·075
= ·273 ÷ 75
= ·00364 *Ans.*

(7) ·03 ÷ ·0008
= 300 ÷ 8
= 37·5 *Ans.*

1 ÷ ·0064
= 10000 ÷ 64
= 156·25 *Ans.*

11 ÷ 256
= 11·000 ÷ 256
= ·04296875 *Ans.*

(8) 7·03098 ÷ 6700
= ·0703098 ÷ 67
= ·0010494 *Ans.*

9 ÷ 144000
= ·009 ÷ 144
= ·0000625 *Ans.*

(9) 40137 ÷ 13·6
= 401370 ÷ 136
= 2951·25 *Ans.*

12345 ÷ ·823
= 12345000 ÷ 823
= 15000 *Ans.*

(10) 175·68 ÷ 7
= 25·09714$\frac{2}{7}$ *Ans.*

·6594 ÷ 9
= ·07326$\frac{2}{3}$ *Ans.*

·00357 ÷ 1·1
= ·0357 ÷ 11
= ·00324$\frac{6}{11}$ *Ans.*

(11) 169 ÷ ·0000728
= 1690000000 ÷ 728
= 130000000 ÷ 56
= 2321428$\frac{4}{7}$ *Ans.*

·27 ÷ ·10465
= 27000 ÷ 10465
= 2·58 nearly *Ans.*

Reduction of Vulgar Fractions to Decimals.

Ex. 47.

(1) $\frac{1}{2}=1\cdot0\div2=\cdot5$ *Ans.* $\frac{1}{4}=1\cdot0\div4=\cdot25$ *Ans.*
$\frac{3}{4}=3\cdot0\div4=\cdot75$ *Ans.* $\frac{1}{8}=1\cdot0\div8=\cdot125$ *Ans.*
$\frac{3}{16}=3\cdot0\div16=\cdot1875$ *Ans.* $\frac{7}{20}=\cdot7\div2=\cdot35$ *Ans.*
$\frac{6}{25}=6\cdot0\div25=\cdot24$ *Ans.* $\frac{7}{800}=\cdot07\div8=\cdot00875$ *Ans.*

(2) $\frac{12}{75}=\frac{4}{25}=4\cdot0\div25=\cdot16$ *Ans.* $16\frac{71}{125}=16\frac{568}{1000}=16\cdot568$ *Ans.*
$3\frac{101}{256}=3+101\cdot0\div256=3\cdot39453125$ *Ans.*
$\frac{5100}{1088}=\frac{300}{64}=\frac{75}{16}=4\cdot6875$ *Ans.*
$10\frac{13}{625}=10\frac{104}{5000}=10\frac{208}{10000}=10\cdot0208$ *Ans.*
$\frac{24921}{3250}=\frac{99684}{13000}=\frac{7668}{1000}=7\cdot668$ *Ans.*

(3) $3\frac{8}{9}$ of $1\frac{7}{32}$ of $2\frac{5}{14}=\frac{35}{14}\times\frac{39}{32}\times\frac{35}{9}=\frac{11}{2}\times\frac{13}{32}\times\frac{5}{1}=\frac{715}{64}=11\cdot171875$ *Ans.*
$\frac{35\frac{3}{7}}{53\frac{1}{3}}$ of $\frac{\cdot35}{3\cdot3}$ of $\frac{7}{70\frac{5}{11}}=\frac{7\times11}{775}\times\frac{35}{330}\times\frac{248\times3}{160\times7}=\frac{1}{155}\times\frac{7}{10}\times\frac{31}{20}$
$=7\div1000=\cdot007$ *Ans.*

(4) $\frac{27}{320}=\frac{135}{1600}=\frac{675}{8000}=\cdot675\div8=\cdot0843\frac{3}{4}$ *Ans.*
$\frac{5}{13}=\frac{5\cdot0}{13}=\cdot3846\frac{2}{13}$ *Ans.* $\frac{2}{21}=\frac{2\cdot00}{21}=\cdot0952\frac{8}{21}$ *Ans.*
$\frac{4\frac{1}{2}}{8\frac{1}{4}}$ of $\frac{2}{7\cdot3}$ of $143\frac{3}{8}=\frac{9\times4}{33\times2}\times\frac{20}{73}\times\frac{1147}{8}=\frac{17205}{803}=21\cdot4259\frac{23}{803}$
Ans.

(5) $\frac{5}{7}=5\cdot0\div7=\cdot714286$ *Ans.* $\frac{3}{11}=3\cdot0\div11=\cdot272727$ *Ans.*
$\frac{11}{600}=\cdot11\div6=\cdot018333$ *Ans.* $\frac{1000}{19}=52\cdot631579$ *Ans.*
$\frac{1}{241}=1\cdot000\div241=\cdot004149$ *Ans.* $\frac{151}{13}=11\cdot615385$ *Ans.*
$1\frac{18}{29}=1\cdot620690$ *Ans.* $\frac{2\frac{1}{7}}{5\frac{3}{4}}=\frac{15\times4}{23\times7}=\frac{60}{161}=\cdot372671$ *Ans.*

(6) $\frac{4\frac{4}{7}}{5\frac{5}{9}}$ of $\frac{29}{4800}$ of $\frac{1\cdot7689}{667}=\frac{32\times9}{50\times7}\times\frac{1}{4800}\times\frac{1\cdot7689}{23}=\frac{3}{50}\times\frac{1}{50}\times\frac{\cdot2527}{23}$
$=\frac{12}{10000}\times\frac{\cdot2527}{23}=\cdot000013$ *Ans.*

$\frac{5\frac{1}{2}}{7\frac{1}{6}}$ of $\cdot54193=\frac{\cdot54193\times33}{43}=\cdot415900$ *Ans.*

Circulating Decimals.

Ex. 48.

(1) $\frac{4}{9}=\cdot\dot{4}$ *Ans.* $\frac{1}{3}=\frac{3}{9}=\cdot\dot{3}$ *Ans.* $\frac{7}{18}=7\cdot0\div18=3\cdot5\div9=\cdot3\dot{8}$ *Ans.*
$\frac{5}{12}=5\cdot0\div12=\cdot41\dot{6}$ *Ans.*

(2) $\frac{8}{11}=\frac{72}{99}=\cdot\dot{7}\dot{2}$ *Ans.* $\frac{13}{41}=13\cdot0\div41=\cdot3170\dot{7}$ *Ans.*
$\frac{27}{110}=2\cdot7\div11=\cdot24\dot{5}$ *Ans.* $\frac{829}{1350}=32\cdot9\div135=6\cdot58\div27$
$=\cdot24370\dot{3}$ *Ans.*

(3) $\frac{29}{101}=29\cdot0\div101=\cdot2871$ *Ans.* $\frac{172}{2710}=17\cdot2\div271=\cdot063468$ *Ans.*
$\frac{12077}{111000}=12\cdot077\div111=\cdot108801$ *Ans.*

(4) $\frac{562}{2079}=562\cdot0\div2079=\cdot270322$ *Ans.*
$\frac{52337}{245700}=523\cdot37\div2457=\cdot21301180$ *Ans.*
$\frac{4}{239}=4\cdot00\div239=0167364$ *Ans.*

Ex. 49.

(1) $\cdot\dot{8}=\frac{8}{9}$ *Ans.* $\cdot2\dot{4}=\frac{24}{99}=\frac{8}{33}$ *Ans.* $\cdot29\dot{7}=\frac{297}{999}=\frac{11}{37}$ *Ans.*
$\cdot24390=\frac{24390}{99999}=\frac{2710}{11111}=\frac{10}{41}$ *Ans.*

(2) $\cdot35282=\frac{1}{100}$ of $35\frac{282}{999}=\frac{11749}{33300}$ *Ans.*
$\cdot5\dot{7}073=\frac{1}{10}$ of $5\frac{7073}{9999}=\frac{1}{10}$ of $5\frac{643}{909}=\frac{2594}{4545}$ *Ans.*
$\cdot714285=\frac{714285}{999999}=\frac{79365}{111111}=\frac{5}{7}$ *Ans.*

(3) $\cdot0204878=\frac{1}{100}$ of $2\frac{4878}{99999}=\frac{1}{100}$ of $2\frac{2}{41}=\frac{21}{1025}$ *Ans.*
$\cdot0012345=\frac{1}{100000}$ of $123\frac{5}{11}=\frac{679}{550000}$ *Ans.*

(4) $\cdot17857142=\frac{1}{100}$ of $17\frac{857142}{999999}=\frac{1}{100}$ of $17\frac{6}{7}=\frac{5}{28}$ *Ans.*
$\cdot13698630=\frac{13698630}{99999999}=\frac{10}{73}$ *Ans.*

(5) $\cdot120034595=\frac{1}{1000}$ of $120\frac{34595}{999999}=\frac{1}{1000}$ of $120\frac{85}{2457}=\frac{11797}{98280}$ *Ans.*
$\cdot432000234=\frac{1}{1000}$ of $432\frac{234}{999999}=\frac{1}{1000}$ of $432\frac{2}{8547}=\frac{1846153}{4273500}$ *Ans.*

(6) $\cdot3146641\dot{3}=\frac{1}{10000}$ of $3146\frac{583}{909}=\frac{2860297}{9090000}$ *Ans.*
$\cdot0015596\dot{5}=\frac{1}{1000}$ of $1\frac{455}{813}=\frac{317}{203250}$ *Ans.*

Addition, Subtraction, etc. of Circulating Decimals.

Ex. 50.

(1) 8·30909091 + 7·03333333 + 13·76437538 + ·88451040 = 29·99131002
or, 29·991310 *Ans.*

(2) ·75361111 + 1·09375044 + 8·93646465 + ·76576577 = 11·54959197
or, 11·549592 *Ans.*

(3) ·84903030 + ·74888889 = ·10014141
or, ·100141 *Ans.*

3·2915648 + ·3921222 = 2·8994426
or, 2·899443 *Ans.*

(4) $3\cdot\dot{7}\times\cdot\dot{5}=\frac{37}{9}\times\frac{5}{9}=2\frac{8}{81}$
or, $2\cdot\dot{0}98765432$ } *Ans.*

$\cdot\dot{1}\dot{2}\times 8=\frac{12}{99}\times 8=\frac{96}{99}$, or $\cdot\dot{9}\dot{6}$ *Ans.*

$7\cdot4\dot{5}\times\cdot\dot{7}\dot{4}\dot{5}\dot{5}=\frac{1}{10}$ of $74\frac{5}{9}\times\frac{7455}{9999}=\frac{671}{90}\times\frac{7455}{9999}=\frac{61\times497}{5454}=5\frac{3047}{5454}$
$=5\cdot55867253$ &c., or $5\cdot55867\frac{1}{4}$ nearly. *Ans.*

$\cdot12\dot{3}4\dot{5}67\dot{8}\times18\cdot2=\frac{1}{100}$ of $12\frac{1152226}{333333}\times\frac{91}{5}=\frac{4115222}{3663\times500}$
$=2\frac{2226111}{915750}$, or $2\cdot2460\dot{1}3458\dot{3}$ *Ans.*

(5) $\cdot2358\dot{7}0\dot{3}\times\cdot0143\dot{5}=\frac{1}{10000}$ of $2358\frac{19}{27}\times\frac{35}{2439}=\frac{12737\times7}{10800\times2439}$
$=\frac{47\times7}{10800\times9}=\frac{329}{97200}$, or ·003385 nearly. *Ans.*

$2\cdot\dot{1}69000\times5\cdot1312\dot{1}=2\frac{13000}{76923}\times\frac{1}{1000}$ of $5131\frac{7}{33}=\frac{166846}{76923}\times\frac{16923}{8300}$
$=\frac{88423}{10989}\times\frac{2419}{1650}=11\frac{2349887}{18131850}$, or 11·1296 nearly. *Ans.*

(6) $24\cdot\dot{6}\div18\cdot\dot{5}=24\frac{2}{3}\div18\frac{1}{2}=\frac{74}{3}\times\frac{2}{37}=\frac{4}{3}=1\cdot\dot{3}$ *Ans.*

$51\cdot\dot{8}\dot{1}\div13\cdot0\dot{0}\dot{9}=51\frac{9}{11}\div13\frac{1}{111}=\frac{30}{11}\times\frac{111}{76}=\frac{3411}{418}$, or $3\cdot9831\frac{1}{4}$ nearly. *Ans.*

$5\cdot1642\dot{5}\div10\cdot\dot{4}=51642\frac{5}{9}\div104444\frac{4}{9}=464783\div940000$
$=9889\div20000=\cdot49445$ *Ans.*

(7) $57{\cdot}211\frac{3}{7}\div 63{\cdot}20\dot{7}=57211\frac{3}{7}\div 63207\frac{7}{99}=792\div 125=6{\cdot}336$ *Ans.*

$8{\cdot}000012\dot{}\div{\cdot}235=8000\frac{120}{9999}\div 235=1600\frac{8}{3333}\div 47=34\frac{142}{3333}$, or $34{\cdot}0426$ *Ans.*

Reduction, etc. of Concrete Decimals.

Ex. 51.

(1) 20) 11·5*s.*
£·575 *Ans.*

12) 10·5*d.*
20) 16·875*s.*
£·84375 *Ans.*

12) 8·25*d.*
20) 7·6875*s.*
£1·384375 *Ans.*

(2) 12) 11·0*d.*
20) 15·916$\dot{6}$*s.*
£·79583$\dot{3}$ *Ans.*

12) 1·75*d.*
20) 13·145833$\dot{3}$*s.*
£3·6572916$\dot{6}$ *Ans.*

12) 10·2222$\dot{2}$*d.*
20) 18·851851$\dot{8}$*s.*
£·94259 *Ans.*

(3) 12) 6·25*d.*
5) 4·52083$\dot{3}$*s.*
Cr. ·90416$\dot{6}$ *Ans.*

12) 11·375*d.*
5) 6·947916$\dot{6}$
Cr. 1·389583$\dot{3}$ *Ans.*

(4) 12) 7·5*d.*
100) 2·625*s.*
·02625 of £5 *Ans.*

12) 3·75*d.*
27) 32·3125*s.*
Moid. 1·196759$\dot{2}$ *Ans.*

(5) 12) 6·55$\dot{5}$*d.*
21) 20·546296$\frac{8}{27}$*s.*
Guin. ·978395$\frac{5}{81}$ *Ans*

30) 5·75*d.*
Hf. cr. ·191$\dot{6}$ *Ans.*

(6) $\frac{56d.}{105d.}=\frac{8}{15}=\cdot5\dot{3}$ *Ans.*

$\frac{8\frac{3}{5}s.}{12\frac{1}{8}s.}=\frac{70}{97}=\cdot721649\frac{47}{97}$ *Ans.*

(7) $\frac{13s.\ 3\frac{3}{4}d.}{355s.}=\frac{53\frac{1}{4}s.}{1420s.}=\frac{213}{1420\times4}=\frac{3}{80}=\cdot0375$ *Ans.*

$\frac{129\frac{1}{5}d.}{26\frac{5}{7}d.}=\frac{646\times7}{187\times5}=\frac{38\times7}{11\times5}=\frac{266}{55}=4{\cdot}83\dot{6}$ *Ans.*

(8) 12) 4·5*d.*
20) 13·375*s.*
£2·66875 *Ans.*

$\frac{53\frac{3}{5}s.}{52\frac{1}{2}s.}=\frac{61}{60}=1\cdot01\dot{6}$ *Ans.*

(9) 12*d.*) 4·5*d.*
200*s.*) ·375*s.*
·001875 *Ans.*

$\frac{21s.\times47\frac{1}{2}}{20s.\times47\frac{1}{2}}=\frac{21}{20}=1\cdot05$ *Ans.*

(10) 20) 11·0 dwt.
12) 9·55 oz.
Lb. ·79583 *Ans.*

24) 15·0 grs.
20) 33·625 dwt.
Oz. 1·68125 *Ans.*

(11) 16) 9·0 oz.
28) 16·5625 lbs.
4) ·59151785$\frac{5}{7}$ qr.
Cwt. ·14787946$\frac{3}{7}$ *Ans.*

16) 13·0 oz.
28) 17·8125 lb.
80) 3·636160$\frac{5}{7}$ qr.
Ton ·045452$\frac{1}{112}$ *Ans.*

(12) $\frac{5760\text{ grs.}\times10\cdot5}{7000\text{ grs.}}=\frac{576\times15}{1000}$ lbs. Av.$=\frac{576\times15}{112000}$ cwt.

$=\frac{36\times15}{7000}$ cwt.$=\cdot07\dot{7}14285\dot{7}$ cwt. *Ans.*

$\frac{7000\text{ grs.}\times21}{5760\text{ grs.}\times16}=\frac{175\times7}{48\times16}$ lbs. Tr.$=1\cdot595052083$ lbs. Tr. *Ans.*

(13) $\frac{11\frac{3}{4}\text{ cwt.}}{20\text{ cwt.}\times12\frac{1}{2}}=\frac{47}{1000}=\cdot047$ *Ans.*

$\frac{9\text{ cwt. }75\text{ lbs.}}{7\frac{3}{8}\text{ cwt.}}=\frac{1083\times5}{38\times112}=\frac{57\times5}{2\times112}=1\cdot272321\frac{1}{7}$ *Ans.*

(14) 12) 6·5 in.
3) 2·541$\dot{6}$ ft.
1760 54·847$\frac{2}{9}$ yds.
160) 4·986$\frac{1}{9}$
Mi. ·031163194 *Ans.*

$\frac{54\text{ yds. }2\frac{13}{24}\text{ ft.}}{13\text{ yds. }2\frac{1}{4}\text{ ft.}}=\frac{1316\frac{1}{2}}{330}=\frac{3949}{330\times3}$

$=\frac{35\cdot9}{9}=3\cdot9\dot{8}$ *Ans.*

(15) 60) 18·0 sec.
60) 15·3 min.
24) 19·255 hrs.
Da. ·8022916 *Ans.*

$\frac{19\text{ hrs. }15\frac{3}{10}\text{ min.}}{22\text{ hrs. }56\frac{1}{30}\text{ min.}}=\frac{34659}{41281}$

$=\cdot839587$ nearly. *Ans.*

(16) 40) 36·5 po.
4) 3·9125 ro.
Ac. ·978125 *Ans.*

$\frac{3 \text{ ro. } 36\frac{1}{2} \text{ po.}}{4 \text{ ro. } 33 \text{ po.}} = \frac{156{\cdot}5}{193} = \frac{313}{386}$
$= {\cdot}81088083$ nearly. *Ans.*

(17) 144) 100·0 in.
9) 7·69$\dot{4}$
Sq. yds. 23·854938 &c. *Ans.*

$\frac{23 \text{ sq. yds. } 7\frac{25}{36} \text{ ft.}}{32\frac{3}{4} \text{ sq. yds.}} = \frac{214\frac{25}{36}}{32\frac{3}{4} \times 9}$
$= \frac{7729}{131 \times 81} = \frac{59}{81} = {\cdot}728395061\dot{}$ *Ans.*

(18) 4) 3·7 pks.
8) 13·925 bu.
Qu. 1·740625 *Ans.*

$\frac{55{\cdot}7 \text{ pks.}}{25\frac{1}{8} \text{ pks.}} = \frac{1671}{760} = 2{\cdot}198684\frac{2}{19}$ *Ans.*

Ex. 52.

(1) £·375
20
7·500*s.*
7*s.* 6*d.* *Ans.*

£·765625
20
15·312500*s.*
12
3·7500 = $3\frac{3}{4}$*d.*
15*s.* $3\frac{3}{4}$*d.* *Ans.*

£1·809375
20
16·187500*s.*
12
2·2500 = $2\frac{1}{4}$*d.*
£1 16*s.* $2\frac{1}{4}$*d.* *Ans.*

(2) £·095
20
1·900*s.*
12
10·8 = $10\frac{4}{5}$*d.*
1*s.* $10\frac{4}{5}$*d.* *Ans.*

£·028125
20
·562500*s.*
12
6·7500 = $6\frac{3}{4}$*d.* *Ans.*

£9·6890625
20
13·7812500*s.*
12
9·37500 = $9\frac{3}{8}$*d.*
£9 13*s.* $9\frac{3}{8}$*d.* *Ans.*

(3) ·2345 of £5
5
£1·1725
20
3·4500*s.*
12
5·40 = $5\frac{2}{5}$*d.*
£1 3*s.* $5\frac{2}{5}$*d.* *Ans.*

$2{\cdot}817\frac{5}{6}$ of 15*s.*
3
$8{\cdot}453\frac{1}{2}$
5
$42{\cdot}267\frac{1}{2}$*s.*
12
3·210*d.*
42*s.* $3\frac{21}{100}$*d.* *Ans.*

2·375 *moid.*
27
64·125*s.*
12
1·500 = $1\frac{1}{2}$*d.*
64*s.* $1\frac{1}{2}$*d.* *Ans.*

(4) ·085 *hf. cr.*
30
2·550=2$\frac{11}{20}$*d. Ans.*

·8513 *hf. sov.*
10
8·513*s.*
12
8*s.* 6·156*d. Ans.*

2) 9·917 of 6*d.*
4·9585*s.*
12
11·5020*d.*
4*s.* 11$\frac{251}{500}$*d. Ans.*

(5) 26·5 of 3$\frac{1}{3}$*s.*
10
3) 265
88*s.* 4*d. Ans.*

·0265 of 28$\frac{1}{2}$*d.*
28$\frac{1}{2}$
·01325
·7420
·75525*d.*=$\frac{3021}{4000}$*d. Ans.*

3·65 of 285*d.*
285
12) 1040·25*d.*
86*s.* 8$\frac{1}{4}$*d. Ans.*

(6) 1·00515 of 72$\frac{1}{2}$*s.*
72$\frac{1}{2}$
·502575
72·37080
72·873375*s.*
12
10·480500*d.*
72*s.* 10$\frac{961}{2000}$*d. Ans.*

·789$\frac{5}{7}$ of 110*s.* 7$\frac{1}{2}$*d.*=110$\frac{5}{8}$*s.* $\times \frac{5 \cdot 528}{7}$
=12*d.* × 885 × ·691 ÷ 7
12
10620
·691
7) 7338·420*d.*
12) 1048·34$\frac{4}{7}$
87*s.* 4·34$\frac{4}{7}$*d.* or 87*s.* 4$\frac{121}{350}$*d. Ans.*

(7) ·8325 cwt.
4
3·3300 qrs.
28
9·24 lbs.
16
3·84 oz.
3 qrs. 9 lbs. 3·84 oz. *Ans.*

·08745 t.
20
1·74900 cwt.
4
2·996 qrs.
28
27·888 lbs.
1 cwt. 2 qrs. 27·888 lbs. *Ans.*

·3275 lb.
16
5·2400 oz.
16
5 oz. 3·84 drs. *Ans.*

(8) 7·334375 ac.
4
1·337500 ro.
40
13·5000 po.
7 ac. 1 ro. 13$\frac{1}{2}$ po. *Ans.*

£10·917$\frac{3}{5}$
20
18·352
12
£10 18*s.* 4·224*d. Ans.*

3·1095 yds.
3
·3285 ft.
12
3·9420 in.
3 yds. 3·942 in. *Ans.*

(9) ·985 Eng. ell
5
4) 4·925
1·23125 yds.
3
·69375 ft.
12
8·32500 in.
1 yd. $8\frac{13}{40}$ in. *Ans.*

$7{\cdot}78\frac{3}{4}$ gal.
4
3·15 qts.
2
0·30 pt.
7 gal. 3 qts. 0·30 pt. *Ans.*

·31694 ac.
4
1·26776 ro.
40
10·7104 po.
1 ro. 10·7104 po. *Ans.*

(10) ·211648 mi.
1760
372·50048 yds. *Ans.*

21) £3·675
·175
Guin. 3·500 *Ans.*

(11) 3 cwt. 1 qr. 10 lbs. × ·40985
4
13
28
374 lbs. × ·40985 = 153·2839 lbs.
= 1 cwt. 41·2839 lbs. *Ans.*

$4{\cdot}1734\frac{1}{6}$ lbs. Tr.
12
2·0810 oz.
20
1·620 dwt.
24
14·88 grs. *Ans.*
4 lbs. 2 oz. 1 dwt.

(12) £·$103\frac{7}{9}$
20
2·$075\frac{5}{9}$ *s.*
12
0·$906\frac{2}{3}$ *d.* = $\frac{2720}{3000}$ *d.*
2 *s.* $0\frac{68}{75}$ *d.* *Ans.*

·$091\frac{2}{3}$ *cr.*
60
5·500
or, $5\frac{1}{2}$ *d.* *Ans.*

$1{\cdot}00\frac{5}{9}$ *guin.*
21
$21{\cdot}11\frac{2}{3}$ *s.*
12
1·40
21 *s.* $1\frac{2}{5}$ *d.* *Ans.*

(13) ·$046\frac{8}{27}$ of 6 *guin.*
6
·$277\frac{7}{9}$ *guin.*
21
$5{\cdot}833\frac{1}{3}$ *s.*
12
5 *s.* 10·000 *d.* *Ans.*

$3{\cdot}40\frac{1}{9}$ of $14\frac{2}{3}$ *s.*
44
3) 149·64$\frac{8}{9}$
49·88$\frac{8}{27}$ *s.*
12
$10{\cdot}59\frac{5}{9}$ *d.* = $10\frac{536}{900}$ *d.*
£2 9 *s.* $10\frac{134}{225}$ *d.* *Ans.*

(14) $\cdot87\dot{1}3821$ of $30\frac{3}{4}s.$
$=\cdot87\frac{17}{123}$ of $\frac{123}{4}s.$
123
4) 107·18
26·795s.
12
26s. 9·540d. *Ans.*

$\cdot76340\frac{8}{99}$ of 3 mi.
3
2·29020$\frac{8}{33}$ mi.
8
2·32161$\frac{31}{33}$ fur.
220
70·75626$\frac{2}{3}$ yds.
3
2mi. 2f. 70yds. 2·26880 ft. *Ans.*

MISCELLANEOUS EXERCISES.

Ex. 53.

(1) $\frac{10961}{11639}=\frac{113\times97}{113\times103}=\frac{97}{103}$ *Ans.* Also, $\frac{97}{103}\div9=\frac{97}{927}$ *Ans.*

(2) $\frac{7}{80}=\cdot70\div8=\cdot0875$
$\frac{5}{64}=5\div64=\cdot078125$
$\cdot009375$
$\cdot9\div\cdot009375=900000\div9375$
$=96$ *Ans.*
By Vulgar Fractions: $\frac{9}{10}\div(\frac{7}{80}-\frac{5}{64})=\frac{288}{320}\div(\frac{28}{320}-\frac{25}{320})$
$=288\div3=96$ *Ans.*

(3) $1111\cdot11\dot{1}\div109=10\cdot19368$ nearly. *Ans.*

(4) $5\frac{16}{51}-\frac{11}{84}=5\frac{32}{102}-\frac{33}{102}=5-\frac{1}{102}=4\frac{101}{102}$ *Ans.*
$20s.\times\cdot217945=4\cdot35890s.$
$21s.\times\cdot00215=\cdot04515$
$4\cdot31375s.=4s.\ 3\cdot765d.$ *Ans.*

(5) $\frac{43}{48}+\frac{89}{98}+\frac{25}{112}=\frac{2107+2136+525}{2352}=\frac{4768}{2352}=\frac{298}{147}$
$\frac{21}{149}$ of $\frac{298}{147}=\frac{2}{7}$ *Ans.*

(6) £78 16*s.* 9*d.* − £63 = £15 16*s.* 9*d.* for duty, &c.
Ratio = £15 16*s.* 9*d.* : £63 = $316\frac{3}{4}s.$: $20s.\times63$
$=1267:80\times63=181:720$ *Ans.*

(7) First there remains $\frac{4}{5}$, then $\frac{7}{9}$ of $\frac{4}{5}=\frac{28}{45}$, and lastly $\frac{6}{7}$ of $\frac{28}{45}=\frac{8}{15}$ *Ans.*

(8) Value of 1 gal. $=\frac{1}{65\frac{1}{4}}$ of £73 13*s.* 9*d.*

do. of $9\frac{2}{3}$ gal. $=\frac{9\frac{2}{3}}{65\frac{1}{4}}$ of £73 13*s.* 9*d.*

$\frac{29\times4}{261\times3}$ or $\frac{4}{27}$ of £73 13*s.* 9*d.*=£10 18*s.* 4*d.* *Ans*

(9) 21*s.*=$1\frac{1}{7}$ of the money given for 7 dozen lbs. of sugar;
or, 21*s.*=8 times the money given for 12 lbs. of sugar;
$\therefore$ 21*s.*$\div(12\times8)=2\frac{5}{8}$*d.* per lb. *Ans.*

(10) Circumf. of dial plate$=3{\cdot}65\times60$ inches$=3{\cdot}65\times5$ feet;
5·809155 ft. : $3{\cdot}65\times5$ ft. :: 113 in. : $\frac{3650000\times113}{1161831}$
$=355$ very nearly. *Ans.*

Ex. 54.

(1) $18{\cdot}154\frac{1}{8}$ sq. ft.$\div(9\times30\frac{1}{4})=145{\cdot}233\div(9\times242)$
$=\frac{145233}{9000\times242}=\frac{13203}{9000\times22}=\frac{1467}{22000}$ sq. po. *Ans.*

(2) $(25\frac{5}{7}d.-3\frac{1}{8}d.)\div\frac{3}{8}$ of $\frac{3}{7}$ of $\frac{15}{2}d.=22\frac{33}{56}d.\div\frac{5}{7}d.=\frac{1265}{40}=31\frac{5}{8}$ *Ans.*

(3) $\frac{3\frac{1}{9}+4\frac{5}{6}}{21\frac{1}{8}-1\frac{1}{12}}\times\frac{6}{6}=\frac{18\frac{2}{3}+29}{126\frac{3}{4}-6\frac{1}{2}}$; and this$\times\frac{12}{12}$ gives $\frac{224+348}{1521-78}$
$=\frac{572}{1443}=\frac{44}{111}$ *Ans.*

Also; $108{\cdot}09375=108\frac{3}{32}=108\frac{15}{160}$
$\cdot15=0\frac{3}{20}=0\frac{24}{160}$
$20{\cdot}00625=20\frac{1}{160}=20\frac{1}{160}$
$128{\cdot}25000=128\frac{1}{4}=128\frac{25}{100}$
$-73{\cdot}52=73\frac{13}{25}=73\frac{52}{100}$
Ans. $54{\cdot}73=54\frac{73}{100}$

(4) Quantity for 21*s.*$=3\frac{5}{7}$ yds.; do. for 1*s.*$=\frac{1}{21}$ of $3\frac{5}{7}$ yds.

$\therefore$ do. for $2\frac{1}{13}s.=\frac{2\frac{1}{13}}{21}$ of $3\frac{5}{7}$ yds.

$$\frac{26\text{ yds.}\times 27}{7\times 21\times 13}=\frac{2\times 9}{7\times 7}=\frac{18}{49}\text{ yd. } \textit{Ans.}$$

(5) 1st price per yd.$=6\frac{1}{4}$ *guin.* $\div 31\frac{1}{8}=\frac{25\text{ guin.}\times 5}{156\times 4}=\frac{21s.\times 125}{156\times 4}$;

2nd price per yd.$=£4\frac{1}{12}\div 11\frac{3}{8}=\frac{£7\times 2}{13\times 3}=\frac{20s.\times 14}{39}$;

$$1\text{st}\div 2\text{nd}=\frac{21\times 125}{156\times 4}\times\frac{39}{20\times 14}=\frac{3\times 25}{16\times 4\times 2}=\frac{75}{128};$$

or, the prices per yd. are as 75 : 128 *Ans.*

(6) 33 yds. 2 ft. $8\frac{1}{2}$ in.$=33\frac{65}{72}$ yds.; $\therefore$ 1 yd.$=31$ mètres$+33\frac{65}{72}$
$=\frac{2232}{2441}$ of a mètre; also, $\frac{5}{4}$ yd. $\times 65{\cdot}61828=82{\cdot}02285$ yds.

hence, $\frac{82{\cdot}02285\times 2232}{2441}=\frac{183075}{2441}$ nearly, $=75$ nearly. *Ans.*

(7) The quotient will be $=\cdot 859\div\frac{4}{9}=\frac{859}{1000}\times\frac{9}{4}$;

$$1{\cdot}00503\div\left(\frac{859}{1000}\times\frac{9}{4}\right)=\frac{1005{\cdot}03\times 4}{859\times 9}=\frac{1{\cdot}17\times 4}{9}=\cdot 52 \textit{ Ans.}$$

(8) $(\frac{1}{9}+\frac{3}{10}+\frac{5}{12})\times$ the no. of *ninths* is to amount to $93\frac{1}{8}$;
$93\frac{1}{8}\div(\frac{1}{9}+\frac{3}{10}+\frac{5}{12})=\frac{745}{8}\div\frac{149}{180}=5\times\frac{180}{8}=112\frac{1}{2}$ *ninths*;
therefore there will be $337\frac{1}{2}$ *tenths* and $562\frac{1}{2}$ *twelfths*; and the aggregate parts will be $\frac{112\frac{1}{2}}{9}$, $\frac{337\frac{1}{2}}{10}$, $\frac{562\frac{1}{2}}{12}$, or $12\frac{1}{2}$, $33\frac{3}{4}$, $46\frac{7}{8}$

Ans.

(9) *A* goes $\frac{40}{11}$ yds. in 1 second, *B* $\frac{328}{81}$ yds. in 1 second.
1760 yards $\times 10-\frac{40}{11}$ yard $\times 3\frac{3}{8}=17600-13\frac{1}{11}=17586\frac{10}{11}$ yards passed over by *A* and *B* jointly, at the united rate of $\frac{40}{11}+\frac{328}{81}$ yards per second;

$$\therefore 17586\tfrac{10}{11}\div\left(\frac{40}{11}+\frac{328}{81}\right)=\frac{193456}{11}\times\frac{891}{6848}=\frac{113\times 81}{4}$$
$$=2288\tfrac{1}{4}\text{ sec.}=38\text{ min. }8\tfrac{1}{4}\text{ sec. } \textit{Ans.}$$

(10) The G. C. M. of 4230590 and 9999999 is 4649; and that of 18084 and 99999999 is 4521; hence, $\cdot\dot{4}230590\dot{4}=\frac{910}{2151}$ *Ans.*

Also, $\cdot 0100018084\dot{4}=\frac{1}{100}$ of $1\frac{4}{22119}=\frac{221228}{2211900}$ *Ans.*

Ex. 55.

(1) $\frac{6\frac{2}{7}}{6\frac{1}{2}}$ of $\left(\frac{67}{144}-\frac{43}{132}\right)=\frac{44\times2}{13\times7}\times\frac{737-516}{1584}=\frac{1}{91}\times\frac{221}{18}$

$=\frac{1}{7}\times\frac{17}{18}=\frac{17}{126}$ *Ans.*

(2) $11111\cdot01+\cdot5757=111110100\div5757=19300$ *Ans.*

(3) $\frac{10s.\ 9\frac{3}{8}d.}{76s.\ 8d.}=\frac{86s.\ 3d.}{76s.\ 8d.\times8}=\frac{1035}{920\times8}=\frac{9}{64}=\cdot140625$ *Ans.*

(4) 10·7965 ac.
4

43·1860 ro. + 5·075 ro. = 48·261 ro. = 1930·44 po.

119·75

40) 1810·69

Ans. 11 ac. 1 ro. 10·69 po. 45 ro. 10·69 po.

(5) $15\frac{15}{32}$ and $29\frac{13}{28}=\frac{495}{32}$ and $\frac{825}{28}=\frac{3465}{224}$ and $\frac{6600}{224}$; 3465 and 6600 have for their G. C. M. 165, and for their L. C. M. 138600; hence,

the G. C. M. of the given quantities is $\frac{165}{224}$
and L. C. M. $=\frac{138600}{224}=\frac{2475}{4}=618\frac{3}{4}$ } *Ans.*

(6) $\frac{7}{8\frac{1}{3}}$, $\frac{3\frac{1}{5}}{8\frac{1}{2}}$, and $\frac{2\frac{1}{2}}{8\frac{1}{4}}=\frac{1}{8\frac{1}{3}\div7}$, $\frac{1}{8\frac{1}{2}\div3\frac{1}{5}}$, $\frac{1}{8\frac{1}{4}\div2\frac{1}{2}}$

$=\frac{8}{66\frac{2}{3}\div7}$, $\frac{8}{68\div3\frac{1}{5}}$, $\frac{8}{66\div2\frac{1}{2}}=\frac{8}{9\frac{11}{21}}$, $\frac{8}{21\frac{1}{4}}$, $\frac{8}{26\frac{2}{5}}$ *Ans.*

(7) $\left.\begin{matrix}\frac{5}{8}\text{ of }\cdot315 : 1\text{ work}\\ 16\cdot28 : 3\cdot663\text{ da.}\end{matrix}\right\}$ :: 28 m. : $\frac{28\text{ m.}\times3663\times8\times100}{5\times315\times1628}$

$\frac{3663\times8\times4}{9\times407}=8\times4=32$ m. *Ans.*

(8) £6 8*fl.* 5 *cts.* 3 *mls.* £6 8*s.* $5\frac{3}{4}$*d.*
=£6·853 =6167 *farth.*
=960 *farth.* × 6·853;
hence the ratio is that of 6853 × 960 : 6167 × 1000,
=979 × 24 : 881 × 25=23496 : 22025 *Ans.*

(9) Taking 279 mètres = 305 yards, we may state as follows:—

$$\left.\begin{array}{l} 168 \text{ Eng. lab.} : \frac{122\times5}{6} \text{ Eng. lab.} \\ \frac{6014\times305}{279} \text{ yds.} : 4850 \text{ yds.} \\ \frac{1\frac{7}{13}\times305}{279} \text{ yds.} : \frac{5\frac{1}{3}}{3} \text{ yd.} \\ \frac{1\frac{1}{12}\times305}{279} \text{ yds.} : 1\frac{1}{4} \text{ yd.} \\ 8\frac{6}{7} \text{ hrs.} : 7\frac{5}{8} \text{ hrs.} \end{array}\right\} :: 13\tfrac{5}{9} \text{ days}$$

The above statement may be simplified by the removal of fractions, &c. as follows:—

$$\left.\begin{array}{r} 168\times6 : 122\times5 \\ 62\times305 : 50\times279 \\ 20\times305\times3 : 16\times93\times13 \\ 13\times305 : 15\times279 \\ 62\times8\times9 : 61\times7 \end{array}\right\} :: 122 \text{ days}$$

Cancelling 61 × 61 × 61, also 31 × 31, and 13, from both sides, we have

$$\frac{2\times10\times50\times9\times16\times3\times15\times279\times7}{168\times6\times2\times5\times60\times5\times5\times16\times9}=5\tfrac{13}{16} \text{ da. } \textit{Ans.}$$

(10) When the ·7558 part of any whole is spent there remains the ·2442 part of the whole; and when $\cdot4\frac{450}{999}$, or $\frac{1}{10}$ of $4\frac{50}{111}$ of that remainder is spent, there remains $1-\frac{494}{1110}$, or $\frac{616}{1110}$, of the ·2442 part = ·00022 × 616 = ·13552 of the whole. *Ans.*

Ex. 56.

(1) $16\div425\frac{61}{91}=16\times91\div38736=91\div2421$;
91·000 ÷ 2421 = ·03759 nearly. *Ans.*

(2) 8) $4754\frac{20}{21}$
$4\frac{1}{3}$) $594\frac{13}{21}$ First rem., $4\frac{20}{21} \div 8 = \frac{104}{21} \div 8 = \frac{13}{21}$;
3 3
13) $1783\frac{6}{7}$ Second, $7\frac{6}{7} \div 13 = \frac{55}{7} \div 13 = \frac{55}{91}$;
$3\frac{2}{9}$) $137\frac{55}{91}$
9 9
29) $1234\frac{40}{91}$ Third, $19\frac{43}{91} \div 29 = \frac{1769}{91} \div 29 = \frac{61}{91}$
$425\frac{61}{91}$ *Ans.*

(3) $\cdot 0497\frac{2}{7} : \cdot 3998\frac{8}{9} = 497\frac{2}{7} : 3998\frac{8}{9} = 3481 \times 9 : 35990 \times 7$
$= 59 \times 59 \times 9 : 59 \times 61 \times 70 = 59 \times 9 : 61 \times 70 = 531 : 4270$
Ans.

(4) $\frac{3}{8}$ of 1·44 mile $= \cdot 8640000$ mi.
3·5 miles $\times \cdot 077 \times \cdot 007 = \cdot 0018865$
$\cdot 8658865$
8
6·9270920 fur. $-$ 1·845 fur.
$= 5 \cdot 082092$ fur. $= 5$ fur. 3 po. 1·56024 yd. *Ans.*

(5) $27\frac{1}{2}$ sq. yds. $= \frac{27\frac{1}{2}}{30\frac{1}{4}}$ sq. po. $= \frac{110}{121}$ or $\frac{10}{11}$ sq. po.
3 ac. 1 ro. $38\frac{10}{11}$ po. $\div$ 5 ac. 3 ro. 8 po. $= 558\frac{10}{11}$ po. $\div$ 928 po.
$= 6148 \div (928 \times 11) = 53 \div 88 = \cdot 602\dot{2}\dot{7}$ *Ans.*

(6) 1 lb. is worth $20 \cdot 475s. \div 6 \cdot 37 = 45s. \div 14$; therefore, the no. of lbs. worth 111*s.* 9*d.* will be $111\frac{3}{4} \div \frac{45}{14} = \frac{447}{4} \times \frac{14}{45}$
$= 34$ lbs. $12\frac{4}{15}$ oz. *Ans.*

(7) Calling C's share 1 quantity, B's will be $= \frac{13}{10}$ of that quantity, and A's $= \frac{3}{7}$ of $\frac{13}{10}$ or $\frac{39}{70}$ of it.
Sum of the three $= \frac{39}{70} + \frac{13}{10} + 1 = 2\frac{6}{7}$ times C's share;
$\therefore$ C's share $= 20$ oz. $\div 2\frac{6}{7} = 7$ oz.; B's, $\frac{13}{10}$ of $7 = 9\frac{1}{10}$ oz.;
A's, $\frac{3}{7}$ of $9\frac{1}{10} = 3\frac{9}{10}$ oz. *Ans.*

(8) 9*s.* is left after spending $\frac{1}{4}$ of a sum of money, which sum, therefore, must have been $= 9s. \div \frac{3}{4}$, or 12*s.*; and this, by the

question, is $\frac{1}{8}$ as much again as was possessed immediately before, so that $12s.+1\frac{1}{2}$, or $10s.$, was the sum left after spending $\frac{1}{4}$ of a certain remainder; that remainder, therefore, was $=10s.+\frac{3}{4}=13s.\ 4d.$; and hence $13s.\ 4d.+8d.=14s.$ at first. *Ans.*

(9) 14 yds. $0\frac{6}{7}$ ft. $=42\frac{6}{7}$ ft. $=\frac{299}{7}$ ft.

$$\frac{299 \text{ ft.}}{7}\times\frac{6\frac{1}{4}}{7\frac{2}{7}}\times\frac{\frac{2}{9}(10\frac{3}{10}-\frac{21}{40})}{\frac{1}{18}\text{ of }21\frac{1}{8}\text{ ft.}}=\frac{299 \text{ ft.}}{21\frac{1}{8}\text{ ft.}}\times\frac{6\frac{1}{4}}{51}\times 4(10\tfrac{12}{40}-\tfrac{21}{40})$$

$$=\tfrac{299}{169}\times\tfrac{50}{51}\times\tfrac{391}{10}=\tfrac{23}{13}\times\tfrac{5}{3}\times\tfrac{23}{1}=\tfrac{2645}{39}\ \textit{Ans.}$$

(10) In $8\frac{1}{3}$ days A can do $1{\cdot}6875\times 8$ times as much as B can do in 1 day; or A in 1 day can do $\frac{1{\cdot}6875\times 8}{8\frac{1}{3}}$ times as much as B in 1 day, $=\frac{81}{50}$ as much as B; that is, the time in which A can do the work is to B's time as 50 : 81;

$$\cdot 05\tfrac{1}{3}\text{ of }81 : \cdot 054\text{ of }50,$$
$$\text{or } 16\times 27 : 54\times 5 :: 32\text{ men} : 20\text{ men. } \textit{Ans.}$$

Ex. 57.

(1) $\cdot 41\frac{6}{7}\times 4{\cdot}13=2{\cdot}93\times\cdot 59=1{\cdot}7287$ *Ans.*

$$\cdot 0010\tfrac{5}{8}\div\cdot 068=\cdot 0085\div(\cdot 068\times 8)=85\div(680\times 8)$$
$$=1\div 64, \text{ or } \cdot 015625\ \textit{Ans.}$$

(2) $\frac{11}{12}$ of $5{\cdot}136 gun.=\cdot 428 gun.\times 11=£21\times\cdot 0214\times 11=£4{\cdot}9434$;

$\cdot 0224$ of $1{\cdot}32\frac{1}{7}$ of $£\frac{1}{8}=£\cdot 0004\times 9{\cdot}25 = \cdot 0037$;

$4{\cdot}9471$

$£5{\cdot}274-£4{\cdot}9471=£\cdot 3269=6s.\ 6{\cdot}456d.$ *Ans.*

(3) $\frac{8}{11}$ mi. $+\frac{5}{42}$ fur. $=\frac{24}{11}$ fur. $+\frac{5}{42}$ fur. $=\frac{1063}{462}$ fur.

	fur.	po.	yds.	ft.	in.
1063 fur. $\div 462=$	2	13	0	0	$2\frac{5}{7}$
	2	12	0	0	$6\frac{6}{7}$
	0	0	$4\frac{1}{2}$	2	$7\frac{6}{7}$
				1	$6=\frac{1}{2}$ ft.
			5	1	$1\frac{6}{7}$ *Ans.*

(4) $\cdot 275 = \frac{275}{1000} = \frac{11}{40}$; $\frac{11}{40} - \frac{2}{9}$, or $\frac{19}{360}$, of a yd. costs $9\frac{1}{2}d.$;
$\therefore \frac{1}{360}$ of a yd. costs $\frac{1}{2}d.$; and $\frac{360}{360}$ yd. costs $180d. = 15s.$ *Ans.*

(5) 1 ton = 112 lbs. Av. × 20 = 2240 lbs. Av.
1 cwt. = 112
1 lb. Tr. $= \frac{5760}{7000}$ lb. Av. $= \frac{0^{144}_{175}}{2352^{144}_{175}}$
$612\frac{5}{7}$ cwt. $= 612\frac{5}{7} \times 7 \times 16$ lbs. $= 68624$ lbs.
$68624 \div 2352\frac{144}{175} = 480368 \div 16469{\cdot}76$
$= 48036800 \div 1646976 = 29\frac{1}{6}$ of each. *Ans.*

(6) Here, the first inquiry is—If 6 men take $8\frac{1}{2}$ days, how many men would require $3\frac{3}{4}$ days?—the answer to which is found to be $= 13\frac{3}{5}$ men, thus,

$$3\frac{3}{4} \text{ da.} : 8\frac{1}{2} \text{ da.} :: 6 \text{ m.} : 13\frac{3}{5} \text{ m.}$$

then, $13\frac{3}{5} - 7 = 6\frac{3}{5}$ men are equivalent to the no. of women required; hence,

$$6 \text{ m.} : 6\frac{3}{5} \text{ m.} :: 10 \text{ wom.} : 11 \text{ wom.} \textit{ Ans.}$$

(7) $\frac{3\frac{3}{5}}{5\frac{5}{7}}$ of $\frac{3 \text{ ac. } 3\frac{1}{6} \text{ ro.}}{516\frac{2}{9} \text{ sq. yds.}}$ of $\frac{23\frac{1}{4} \textit{ guin.}}{£1{\cdot}716}$ of $16s.\ 8d.$

$$= £\tfrac{5}{6} \times \frac{21s. \times 93000}{20s. \times 1716 \times 4} \times \frac{91 \times 40 \times 30\frac{1}{4} \text{ sq. yds.}}{3100 \text{ sq. yds.}} \times \frac{18 \times 7}{40 \times 5}$$

$$= £\tfrac{5}{6} \times \frac{21 \times 3}{2 \times 12 \times 4} \times \frac{7 \times 11 \times 63}{10} = \frac{£21 \times 77 \times 21}{128}$$

$= £265\ 5s.\ 9\frac{3}{8}d.$ *Ans.*

(8) The express train goes $\frac{1}{12}$ of $35\frac{1}{5} = 2\frac{14}{15}$ miles during the 5 minutes; $34\frac{18}{30} - 2\frac{14}{15} = 31\frac{1}{2}$ mi. We may now suppose that the two trains will arrive at the terminus together, and that the express has to gain $31\frac{1}{2}$ miles on the luggage train, which it will do in $31\frac{1}{2} \div 16\frac{4}{5} = 1\frac{7}{8}$ hour, the time the luggage train takes to reach the terminus; $\therefore 18\frac{2}{5} \times 1\frac{7}{8} = 34\frac{1}{2}$ mi. *Ans.*

(9) $1\frac{1}{7}$ of the original quantity being diminished by $\frac{2}{11}$ of the amount leaves $\frac{9}{11}$ of $1\frac{1}{7}$, which being diminished $\frac{3}{10}$ leaves $\frac{7}{10}$ of $\frac{9}{11}$ of $1\frac{1}{7}$, and this again being diminished $\frac{1}{4}$ leaves $\frac{3}{4}$ of $\frac{7}{10}$ of

$\frac{9}{11}$ of $1\frac{1}{7}=\frac{27}{55}$ of the original quantity=the no. of cwt. which, at $9\frac{2}{3}d.$ a cwt., amounts to £32 12*s.* 6*d.*, that is, $=7830\div 9\frac{2}{3}$, or 810 cwt.

$\frac{27}{55}$ of the original quantity=810 cwt.;

$\therefore$ original quantity$=810\div\frac{27}{55}=1650$ cwt.$=82\frac{1}{2}$ tons. *Ans.*

(10) $\cdot 54\frac{49}{99}$ cwt. : $16\cdot6\times20$ cwt. :: $1\cdot17s.$

or, $5395 : 332\times99 :: 117s. : \frac{9s.\times332\times99}{415}=\frac{9s.\times4\times99}{5}$

$=3564s.\div5=$£35 12*s.* $9\frac{3}{5}d.$ *Ans.*

Ex. 58.

(1) $\frac{7\frac{2}{3}}{7\frac{1}{3}}$ of $\frac{4}{5}$ of an Eng. ell$=\frac{4\text{ ells}\times65}{5\times66}=\frac{26}{33}$ of an ell. *Ans.*

$\frac{3}{8}$ of $63s.+\frac{1}{4}$ of $3\frac{1}{2}d.=283\frac{1}{2}d.+\frac{7}{8}d.=284\frac{3}{8}d.$

$\frac{2}{7}$ of $66d.=18\frac{6}{7}d.$; and $284\frac{3}{8}-18\frac{6}{7}=266-\frac{27}{56}=265\frac{29}{56}d.$,

which$\div$£2 10*s.* 11*d.*, or 611*d.*, gives $14869\div(611\times56)$

$=\cdot43456$ nearly. *Ans.*

(2) $\frac{1\cdot308\times27\times1728\text{ c. in.}}{277\cdot274\text{ c. in.}}=\frac{30513024}{138637}=220\cdot1$ gal. nearly. *Ans.*

(3) £$6\frac{17}{28}\div$£$8\frac{2}{9}=\frac{185\times9}{74\times28}=\frac{5\times9}{2\times28}=\frac{45}{56}$ *Ans.*

£$6\frac{17}{28}\div8\frac{2}{9}=$£$\frac{45}{46}=\frac{225s.}{14}=16s.\ 0\frac{6}{7}d.$ *Ans.*

(4) $21s.\times4\cdot385 = 92\cdot085$

$5s.\times1\cdot932775 = 9\cdot663875$

Sum $101\cdot748875s.$

Diff. $82\cdot421125s.=\frac{8139991}{6593369}=1\cdot2345$ nearly. *Ans.*

(5) £$\frac{7}{8}=17s.\ 6d.$: £37 13*s.* 8*d.* :: $21\cdot10fr.$

or, 105 *twop.* : 4522 *twop.* :: $21\cdot1fr.$: $908\cdot70\frac{2}{3}fr.$ *Ans.*

(6)

$$\begin{array}{r} \cdot 0735\tfrac{10}{21} \text{ ton} \\ 20 \\ \hline 1\cdot 4709\tfrac{11}{21} \\ +18\cdot 375 \\ \hline 19\cdot 8459\tfrac{11}{21} \text{ cwt.} \end{array} \qquad \begin{array}{r} 19\cdot 8459\tfrac{11}{21} \text{ cwt.} \\ 4 \\ \hline 3\cdot 3838\tfrac{2}{21} \text{ qrs.} \\ 28 \\ \hline 10\cdot 7466\tfrac{2}{3} \\ +\ 1\cdot 0093\tfrac{3}{4} \\ \hline 11\cdot 7560\tfrac{5}{12} \text{ lbs.} \\ 16 \\ \hline 12\cdot 0966\tfrac{2}{3} \text{ oz.} \\ 9\cdot 3333\tfrac{1}{3} \\ \hline 5\cdot 43 \text{ oz. } \textit{Ans.} \end{array}$$

$$\begin{array}{rrrrr} & \text{cwt.} & \text{qrs.} & \text{lbs.} & \\ & 19 & 3 & 11 & \\ 73\tfrac{1}{3} \text{ oz.} + 16 \text{ oz.} = & & & 4 & \\ \hline & 19 & 3 & 16 & \end{array}$$

(7) After spending $\frac{11}{21}$ there remained $\frac{10}{21}$;

$$\tfrac{9}{40} \text{ of } \frac{10\frac{5}{11}}{1\frac{1}{3}-\frac{2}{15}} \text{ of } \frac{1}{2\frac{2}{3}+8\frac{4}{5}} \text{ of } \frac{15 \text{ yds. } 2\cdot 3 \text{ ft.}}{6 \text{ ells } 1\frac{1}{8} \text{ yd.}} \text{ of } \tfrac{10}{21}$$

$$= \tfrac{9}{40} \text{ of } \frac{115\times 5}{6\times 11} \text{ of } \tfrac{15}{172} \text{ of } \frac{47\cdot 3 \text{ ft.}}{7\frac{1}{2} \text{ yds.} + 1\frac{1}{8} \text{ yd.}} \text{ of } \tfrac{10}{21}$$

$$= \tfrac{3}{8} \text{ of } \tfrac{115}{2} \text{ of } \tfrac{15}{172} \text{ of } \frac{43 \text{ ft.}\times 8}{3 \text{ ft.}\times 69} \text{ of } \tfrac{1}{21} = \tfrac{5}{9} \text{ of } \tfrac{15}{4} \text{ of } \tfrac{1}{3} \text{ of } \tfrac{1}{21}$$

$= \frac{25}{168}$ of the original spent in the second instance;

$\therefore \frac{10}{21} - \frac{25}{168} = \frac{55}{168}$ of the original sum amounts to £38 10*s.*;

accordingly, the original sum is £38 10*s.* $\div \frac{55}{168}$ = £117 12*s.*

Ans.

(8) *B* gets $\frac{1}{3}$ of the 1st rem., *C* $\frac{5}{12}$ of it, *D* $\frac{1}{4}$ of it, $\therefore$ *A* $\frac{1}{4}+\frac{2}{5}=\frac{5}{8}$ of it; and $\frac{5}{8}+\frac{1}{3}+\frac{5}{12}+\frac{1}{4}$, or $\frac{13}{8}$ of the united shares of *B*, *C*, and *D*, is = the whole original sum; hence, these three shares = $\frac{8}{13}$ of the whole, and therefore *A* gets $\frac{5}{13}$ of the whole. *Ans.*

(9) £36 13*s.* 4*d.* $\div$ 35*s.* = $733\frac{1}{3} \div 35 = 20\frac{20}{21}$ quarters;

and as 11 ponies = 7 horses, therefore 14 ponies = $\frac{7 \text{ hor.}\times 14}{11}$;

$$\left.\begin{array}{l} 20 \text{ hor. } : \dfrac{7 \text{ hor.}\times 14}{11} \\ 15\frac{3}{4} \text{ qu. } : 20\frac{20}{21} \text{ qu.} \end{array}\right\} :: 63\tfrac{3}{5} \text{ da. } : \frac{318 \text{ da.}}{5} \times \frac{14\times 146\frac{2}{3}}{5\times 11\times 63}$$

$$= \frac{106\times 14\times 440}{25\times 11\times 63} = 1696 \div 45 = 37\tfrac{31}{45} \text{ da. } \textit{Ans.}$$

(10) $\frac{\frac{1}{100}\text{ of }301\frac{4}{11}\text{ of }\frac{1}{10}\text{ of }46\frac{4}{9}}{\frac{1}{100}\text{ of }134\frac{1}{8}}+\frac{\frac{1}{10}\text{ of }60\frac{8}{27}}{5\frac{7}{9}-\frac{1}{10}\text{ of }19\frac{8}{9}}$

$=\frac{3315\times418}{1209\times110}+\frac{1628}{1560-537}=\frac{51\times19}{93}+\frac{148}{93}=12\frac{1}{93}$ *Ans.*

PRACTICE.

Ex. 59.

(1) £325

6*s.* 8*d.*=$\frac{1}{3}$ of £1 | £108 6*s.* 8*d.* *Ans.*

(2) £365

10*s.* 0*d.*=$\frac{1}{2}$ of £1 | 182 10

2 6 =$\frac{1}{4}$ of 10*s.* | 45 12 6

£228 2*s.* 6*d.* *Ans.*

(3) £439

5*s.* 0*d.*=$\frac{1}{4}$ of £1 | 109 15 0

3 4 =$\frac{1}{6}$ of £1 | 73 3 4

£182 18*s.* 4*d.* *Ans.*

(4) £539

5*s.* 0*d.*=$\frac{1}{4}$ of £1 | 134 15

4 0 =$\frac{1}{5}$ of £1 | 107 16

£781 11*s.* *Ans.*

(5) £867

3

5*s.* 0*d.*=$\frac{1}{4}$ of £1 | 2601

216 15

£2384 5*s.* *Ans.*

(6) £768

6*s.* 8*d.*=$\frac{1}{3}$ of £1 | 256

£512 *Ans.*

(7) £1085

9

£976 10*s.* *Ans.*

(8) £597

10*s.* 0*d.*=$\frac{1}{2}$ of £1 | 298 10

1 8 =$\frac{1}{6}$ of 10*s.* | 49 15

£945 5*s.* *Ans.*

(9) £2347

3*s.* 4*d.*=$\frac{1}{6}$ of £1 | 391 3 4

£1955 16*s.* 8*d.* *Ans.*

(10) £1768

6

12*s.* 0*d.*=$\frac{1}{10}$ of £6 | 10608

0 9 =$\frac{1}{16}$ of 12*s.* | 1060 16

66 6

£11735 2*s.* *Ans.*

(11) £547 7

	3829		
2s. 0d. = $\frac{1}{10}$ of £1	54	14	0
0 2 = $\frac{1}{12}$ of 2s.	4	11	2
	59	5	2

£3769 14s. 10d. *Ans.*

(12) £2174

4s. 0d. = $\frac{1}{5}$ of £1	434	16	0
4 0 = $\frac{1}{5}$ of £1	434	16	0
6 8 = $\frac{1}{3}$ of £1	724	13	4

£1594 5s. 4d. *Ans.*

(13) £3065

5s. 0d. = $\frac{1}{4}$ of £1	766	5	0
2 6 = $\frac{1}{2}$ of 5s.	383	2	6
0 2½ = $\frac{1}{12}$ of 2s.6d.	31	18	6½
	£1181	6s.	0½d.

Ans.

(14) £889 ·6

	533	8	0
6d. = $\frac{1}{40}$ of £1	22	4	6
3d. = $\frac{1}{2}$ of 6d.	11	2	3
1½d. = $\frac{1}{2}$ of 3d.	5	11	1½
	£572	5s.	10½d.

Ans.

(15) £969

10s. 0d. = $\frac{1}{2}$ of £1	484	10	0
1 3 = $\frac{1}{8}$ of 10s.	60	11	3
0 3¾ = $\frac{1}{4}$ of 15d.	15	2	9¾
	£1529	4s.	0¾d.

Ans.

(16) £2345 3

	7035		
10s. 0d. = $\frac{1}{2}$ of £1	1172	10	0
3 4 = $\frac{1}{3}$ of 10s.	390	16	8
0 2 = $\frac{1}{20}$ of 40d.	19	10	10
	£8617	17s.	6d.

Ans.

(17) £1811 2

	3622		
8s. 0d. = $\frac{1}{5}$ of £2	724	8	0
0 8 = $\frac{1}{12}$ of 8s.	60	7	4
0 1 = $\frac{1}{8}$ of 8d.	7	10	11
	£4414	6s.	3d.

Ans.

(18) £2714 5

	13570		
1s. 3d. = $\frac{1}{16}$ of £1	169	12	6
0 3 = $\frac{1}{5}$ of 15d.	33	18	6
0 1½ = $\frac{1}{2}$ of 3d.	16	19	3
	£13790	10s.	3d.

Ans.

(19) £765 ·8

	612	0	
1s. 0d. = 1/20 of £1	38	5	
0 4 = 1/3 of 1s.	12	15	
0 0 4/9 = 1/9 of 4d.	1	8	4
	£664	8s.	4d.

Ans.

(20) £239

10s. 0d. = 1/2 of £1	119	10	0
5 0 = 1/2 of 10s.	59	15	0
0 6 = 1/10 of 5s.	5	19	6
0 1 1/2 = 1/5 of 6d.	1	3	10 4/5
0 0 1/2 = 1/6 of 1 1/2 d.	0	3	11 1/5
	£186	12s.	4 3/5 d.

Ans.

(21) £4763

10s. 0d. = 1/2 of £1	2381	10	
1 3 = 1/4 of 10s.	297	13	9
0 1 1/2 = 1/10 of 15d.	29	15	4 1/2
0 0 1/8 = 1/12 of 1 1/2 d.	2	9	7 3/8
	£2711	8s.	8 7/8 d.

Ans.

(22) £1694 ·3

	508	4	0
6d. = 1/12 of 6s.	42	7	0
1 1/2 d. = 1/4 of 6d.	10	11	9
3/12 d. = 1/8 of 1 1/2 d.	1	15	3 1/2
2/12 d. = 1/9 of 1 1/2 d.	1	3	6 1/3
	£564	1s.	6 5/6 d.

Ans.

(23) £17 × 447

3129

	7599		
17s. = 1/20 of £17	379	19	
	£7978	19s.	

Ans.

(24) £13 × 459

1377

	5967		
13s. 0d. = 1/20 of £13	298	7	
1 1 = 1/12 of 13s.	24	17	3
	£6290	4s.	3d.

Ans.

(25) £3029 ·4

	1211	12	
8d. = 1/12 of 8s.	100	19	4
	£1312	11s.	4d.

Ans.

(26) £1495

4

	5980		
16s. 0d. = 1/5 of £4	1196		
1 4 = 1/12 of 16s.	99	13	4
	£7275	13s.	4d.

Ans.

(27) £1234 7 6

1s. 8d. = 1/12 of £1	102	17	3 1/2
	£1131	10s.	2 1/2 d.

Ans.

(28)

	£	s.	d.
	£947	16	8
			9
	8530	10	0
9s. 0d. = $\frac{1}{20}$ of £9	426	10	6
0 9 = $\frac{1}{12}$ of 9s.	35	10	$10\frac{1}{2}$
0 $2\frac{1}{4}$ = $\frac{1}{4}$ of 9d.	8	17	$8\frac{3}{8}$
	£470	19s.	$1\frac{1}{8}$d.

Ans.

(29)

	£	s.	d.
	£677	4	$5\frac{1}{3}$
10s. 0d. = $\frac{1}{2}$ of £1	338	12	$2\frac{2}{3}$
3 4 = $\frac{1}{3}$ of 10s.	112	17	$4\frac{8}{9}$
0 3 = $\frac{1}{40}$ of 10s.	8	9	$3\frac{3}{5}$
0 $0\frac{1}{4}$ = $\frac{1}{12}$ of 3d.	0	14	$1\frac{11}{36}$
	£1137	17s.	$5\frac{31}{36}$d.

Ans.

(30) £2174 [$-\frac{1}{7}$]

2

	4348		
5s. 0d. = $\frac{1}{4}$ of £1	543	10	
3 4 = $\frac{1}{6}$ of £1	362	6	8
0 1 = $\frac{1}{40}$ of 40d.	9	1	2
0 $0\frac{1}{2}$ = $\frac{1}{2}$ of 1d.	4	10	7
	5267	8	5
$\frac{1}{7}$ of 48s. $5\frac{1}{2}$d. =	0	6	$11\frac{1}{14}$
	£5267	1s.	$5\frac{13}{14}$d.

Ans.

(30) *Otherwise.*

	£	s.	d.
	£2173	17	$1\frac{5}{7}$
			2
	4347	14	$3\frac{3}{7}$
5s. 0d. = $\frac{1}{4}$ of £1	543	9	$3\frac{3}{7}$
3 4 = $\frac{1}{6}$ of £1	362	6	$2\frac{2}{7}$
0 1 = $\frac{1}{40}$ of 40d.	9	1	$1\frac{1}{7}$
0 $0\frac{1}{2}$ = $\frac{1}{2}$ of 1d.	4	10	$6\frac{13}{14}$
	£5267	1s.	$5\frac{13}{14}$d.

Ans.

(31)

	£	s.	d.
	£30·145		
			·9
	27·1305		
1s. 3d. = $\frac{1}{16}$ of £1	1·8840625		
0 $3\frac{3}{4}$ = $\frac{1}{4}$ of 15d.	·4710156$\frac{1}{4}$		
	£29·4855781$\frac{1}{4}$		
or,	£29	9s.	8·53$\frac{7}{8}$d.

Ans.

(32) £1·775 = £1 15 6

4

	£	s.	d.
	7	2	0
10s. 0d. = $\frac{1}{2}$ of £1	0	17	9
4 0 = $\frac{1}{5}$ of £1	0	7	$1\frac{1}{5}$
0 10 = $\frac{1}{12}$ of 10s.	0	1	$5\frac{3}{4}$
	£8	8s.	$3\frac{19}{20}$d.

Ans.

(33)

	£	s.	d.
	£1	16	$4\frac{1}{2}$
			3
	5	9	$1\frac{1}{2}$
			8
	43	13	0
qrs. = $\frac{1}{4}$ of 3 cwt.	1	7	$3\frac{3}{7}$
21 lbs. = $\frac{1}{4}$ of 3 qrs.	0	6	$9\frac{27}{32}$
	£45	7s.	$1\frac{7}{32}$d.

Ans.

(34)

	£	s.	d.
	£2	7	$8\frac{3}{4}$
			17
	40	11	$4\frac{3}{4}$
1 qr. = $\frac{1}{4}$ of 1 cwt.	0	11	$11\frac{3}{16}$
16 lbs. = $\frac{1}{7}$ of 1 cwt.	0	6	$9\frac{3}{28}$
4 lbs. = $\frac{1}{4}$ of 16 lbs.	0	1	$8\frac{81}{112}$
	£41	11	$10\frac{3}{14}$d.

Ans.

(35)

£0 13 $5\frac{1}{2}$
6

4 0 9
9

	36	6	9
2 ft. $=\frac{1}{9}$ of 6 yds.	0	8	$11\frac{2}{3}$
8 in. $=\frac{1}{3}$ of 2 ft.	0	2	$11\frac{8}{9}$
3 in. $=\frac{1}{8}$ of 2 ft.	0	1	$1\frac{11}{24}$

£36 19*s.* $10\frac{1}{72}$*d.*
Ans.

(36)

£3 18 6
80

	314	0	0
2 ro. $=\frac{1}{2}$ of 1 ac.	1	19	3
1 ro. $=\frac{1}{2}$ of 2 ro.	0	19	$7\frac{1}{2}$
16 po. $=\frac{1}{5}$ of 2 ro.	0	7	$10\frac{1}{5}$

£317 6*s.* $8\frac{7}{10}$*d.*
Ans.

(37)

$237\frac{3}{4}$ bu. at £1 = £237 15 0

6*s.* 8*d.* $=\frac{1}{3}$ of £1	79	5	0
0 5 $=\frac{1}{16}$ of 80*d.*	4	19	$0\frac{3}{4}$
0 $0\frac{1}{2}$ $=\frac{1}{10}$ of 5*d.*	0	9	$10\frac{7}{8}$

£84 13 $11\frac{5}{8}$*d.*
Ans.

(38)

£0 12 $8\frac{1}{2}$
10

	6	7	1
$7\frac{1}{2}$ ft. $=\frac{1}{12}$ of 10 yds.	0	10	$7\frac{1}{12}$

£6 17*s.* $8\frac{1}{12}$*d.*
Ans.

(39)

£245 15 $9\frac{1}{2}$

10*s.* 0*d.* $=\frac{1}{2}$ of £1	122	17	$10\frac{5}{7}$
3 4 $=\frac{1}{3}$ of 10*s.*	40	19	$3\frac{4}{21}$
0 $2\frac{1}{2}$ $=\frac{1}{16}$ of 40*d.*	2	11	$2\frac{91}{192}$

£166 8*s.* $4\frac{155}{192}$*d.*
Ans.

(40)

£0 5 $3\frac{1}{4}$
3

0 15 $9\frac{3}{4}$
6

	4	14	$10\frac{1}{2}$
3 dwt. $=\frac{1}{20}$ of 3 oz.	0	0	$9\frac{59}{80}$
10 dwt. $=\frac{1}{6}$ of 3 oz.	0	2	$7\frac{5}{6}$
10 gr. $=\frac{1}{24}$ of 10 dwt.	0	0	$1\frac{61}{192}$

£4 18*s.* $4\frac{892}{960}$*d.*
Ans.

RATES PER CENT.

Ex. 60.

(1) $\frac{7}{16}\times 100=\frac{700}{16}$ hundredths$=43\frac{3}{4}$ per cent. *Ans.*

(2) $\frac{2d.}{12d.}\times 100=\frac{100}{6}$ hundredths$=16\frac{2}{3}$ p. c. *Ans.*

(3) $\frac{20}{100}$ of 12*s.* 6*d.*$=\frac{1}{5}$ of 12*s.* 6*d.*$=$2*s.* 6*d.* *Ans.*

(4) $\frac{7d.}{240d.}\times 100=\frac{35}{12}$ hundredths$=2\frac{11}{12}$ p. c. *Ans.*

(5) $\frac{4}{100}$ of £13 15*s.*$=\frac{1}{25}$ of 275*s.*$=$11*s.* *Ans.*

(6) $\frac{0\frac{1}{2}}{100}$ of £25$=\frac{20s.\times 25}{800}=\frac{5}{8}s.=7\frac{1}{2}d.$ *Ans.*

(7) $\frac{12\frac{1}{2}}{100}=\frac{1}{8}$;

	cwt.	qrs.	lbs.
8)	2	3	12
	0	1	12 *Ans.*

(8) $\frac{0\frac{1}{4}}{100}=\frac{1}{400}$;

	£	*s.*	*d.*
4)	£3765	13*s.*	7*d.*
100)	941	8	4·75
	£9	8*s.*	3·4075*d.* *Ans.*

(9) $\frac{32}{52}\times 100=\frac{800}{13}$ hundredths$=61\frac{7}{13}$ p. c. *Ans.*

(10) 6*s.* 9*d.*$-$5*s.* 7½*d.*$=$1*s.* 1½*d.* gained on 5*s.* 7½*d.*

$\frac{13\frac{1}{2}d.}{67\frac{1}{2}d.}\times 100=\frac{2700}{135}$ hundredths$=20$ p. c. *Ans.*

(11) $\frac{15}{100}$ of 12060$=120{\cdot}6\times 15=1809$ pers. *Ans.*

$\frac{18}{100}$ of 1809$=18{\cdot}09\times 18=325{\cdot}62$, the nearest whole no. to which is 326. *Ans.*

(12) $1+\frac{102\frac{1}{2}}{100}$, or $\frac{202\frac{1}{2}}{100}$, or $\frac{81}{40}$ of £744$=$£1506 12*s.* *Ans.*

(13) $1\frac{12}{100}$, or $\frac{112}{100}$, or $\frac{28}{25}$ of $6\frac{1}{4}d.=\frac{28d.}{4}=7d.$ *Ans.*

(14) $22\frac{1}{3}$ in every $23\frac{1}{3}$, or $\frac{22\frac{1}{3}}{23\frac{1}{3}}$, or $\frac{67}{70}$ of the whole are white;
$\frac{67}{70}\times 100=\frac{670}{7}$ hundredths$=95\frac{5}{7}$ p. c. *Ans.*

(15) Bought 312 yds. for 256*s.*, or 3 yds. for $256s.\div 104=2\frac{6}{13}s.$;
sold 3 yds. for $2\frac{2}{3}s.$; hence, the selling price was $\frac{2\frac{2}{3}}{2\frac{6}{13}}$, or $\frac{13}{12}$,
or $1\frac{1}{12}$ of the buying price; and $\frac{1}{12}\times 100=8\frac{1}{3}$ p. c. gain. *Ans.*

(16) 244·55
120·45
365 oz. in the mass; and of this the copper is $\frac{244\cdot55}{365\cdot00}$, which
$\times 100=\frac{4891}{73}$ hundredths, or 67 p. c. *Ans.*
The copper is $\frac{244\cdot55}{120\cdot45}$, or $\frac{67}{33}$ of the zinc; and this $\times 100=\frac{6700}{33}$
hundredths, or $203\frac{1}{33}$ p. c. *Ans.*

(17) To lose $3\frac{1}{8}$ per cent. of the cost of an article is to recover $96\frac{7}{8}$
per cent. of the cost.
Prime cost per ton$=£65\div 7\frac{3}{4}=£260\div 31$;
$\frac{96\frac{7}{8}}{100}$ of $\frac{£260}{31}=\frac{5}{4}$ of $\frac{£13}{2}=£8$ 2*s.* 6*d.* *Ans.*

(18) Buying price per quarter$=£25\div 9=£\frac{225}{9}$.
Selling price per quarter$=£34\frac{3}{4}\div 12=£\frac{139}{48}$.
The selling price is $\frac{139}{48}\div\frac{225}{9}$ of the buying price, $=\frac{139}{48}\times\frac{9}{225}$, or
$\frac{417}{400}$ of the buying price; which $\times 100$ gives $104\frac{1}{4}$ hundredths
of the buying price, showing a gain of $4\frac{1}{4}$ p. c. *Ans.*

(19) Prime cost of each orange$=\frac{11\frac{1}{2}d.}{14}=\frac{23d.}{28}$.
$1\frac{5}{100}$, or $\frac{105}{100}$, or $\frac{21}{20}$ of $\frac{23d.}{28}=\frac{69d.}{80}$, the selling price of each;
$17\frac{1}{4}d.\div\frac{69d.}{80}=\frac{69}{4}\times\frac{80}{69}=20$ oranges. *Ans.*

(20) $6\frac{709}{999}$ hundredths of $£740=£7\frac{2}{5}\times 6\frac{26}{37}=£\frac{37}{5}\times\frac{248}{37}=£49\frac{3}{5}$, which
is $\frac{49\frac{3}{5}}{529\frac{1}{15}}$, or $\frac{3}{32}$ of £529 1*s.* 4*d.*; $\frac{3}{32}\times 100=\frac{75}{8}$ hundredths
$=9\frac{3}{8}$ p. c. *Ans.*

(21) 168 gal. at $23\frac{3}{4}s.$, with 15 p. c. profit, $=\frac{115}{100}$ of $\frac{95s.}{4}\times 168$

$=\frac{1}{2}$ of $19s.\times 21\times 23=4588\frac{1}{2}s.$

159 gal. sold at $27\frac{1}{2}s.=4372\frac{1}{2}s.$

9 gal. to be sold for $216s.$

which is at $216s.\div 9=24s.$ a gal. *Ans.*

(22) Of 5 dresses bought at $55s.$ he sells 2 at $70s.$, and 3 at $52s.\ 6d.$

2 at $70s.=140s.$

3 at $52\frac{1}{2}s.=157\frac{1}{2}$

$297\frac{1}{2}s.$ received for what cost $55s.\times 5$;

therefore the selling price is $\frac{297\frac{1}{2}}{275}$ or $\frac{119}{110}$ of the prime cost;

$\frac{119}{110}\times 100=\frac{11900}{11}$ hundredths$=108\frac{2}{11}$ hundredths of the prime cost; thus showing a gain of $8\frac{2}{11}$ p. c. *Ans.*

Ex. 61.

(1) $\frac{6\frac{1}{4}}{100}$ to be changed to an equivalent fraction with $35s.$ as numerator; hence,

$6\frac{1}{4} : 100 :: 35s. : 560s.$ the den^{r}.$=£28$ *Ans.*

(2) The per centage fraction is $\frac{1\frac{1}{2}}{100}$; hence,

$1\frac{1}{2} : 100 :: 15s.\ 9d. : £52\ 10s.$ *Ans.*

(3) The per centage fraction is $\frac{5}{100}$; hence,

$5 : 100 :: £10\ 3s.\ 7\frac{1}{2}d. : £203\ 12s.\ 6d.$ *Ans.*

(4) The per centage fraction is $\frac{3\frac{1}{2}}{100}$; hence,

$3\frac{1}{2} : 100 :: 63s. : £90$ *Ans.*

(5) $2\frac{1}{2} : 100 :: £8\ 17s.\ 11\frac{1}{2}d. : £355\ 18s.\ 4d.$ *Ans.*

(6) $2\frac{1}{2}$ *grain.* $: £100 :: £39{\cdot}9 : \frac{£399\times 10\times 20}{2\frac{1}{2}\times 21}=£19\times 4\times 20$

$=£1520$ *Ans.*

(7) $\frac{104}{100}$ of the no.$=39$; $\therefore 39 \div \frac{104}{100} = \frac{3900}{104} = 37\frac{1}{2}$ *Ans.*

(8) $\frac{91}{100}$ of the no.$=34\frac{1}{8}$; $\therefore 34\frac{1}{8} \div \frac{91}{100} = \frac{300}{8} = 37\frac{1}{2}$ *Ans.*

(9) $\frac{120}{100}$ of the cost$=1002s.$; $\therefore 1002s. \div \frac{120}{100} = £41\ 15s.$ *Ans.*

(10) Selling price per dozen$=\frac{272\frac{1}{2}s.}{5} = \frac{1089s.}{20}$;

$\frac{100\frac{5}{6}}{100}$, or $\frac{121}{120}$, of the prime cost$=\frac{1089s.}{20} = \frac{1089s. \times 6}{120}$;

hence, $1089s. \times 6 \div 121 = 9s. \times 6 = 54s.$ *Ans.*

(11) Given $166d. = \frac{103\frac{3}{4}}{100}$ of the prime cost, to find what per centage fraction of the prime cost $162d.$ would be:

$166 : 162 :: 103\frac{3}{4} : 101\frac{1}{4}$; showing a gain of $1\frac{1}{4}$ p. c. *Ans.*

(12) Given $52s. = 97\frac{1}{2}$ hundredths of the prime cost, to find what per centage fraction of the prime cost $53\frac{1}{2}s.$ would be:

$52s. : 53\frac{1}{2}s. :: 97\frac{1}{2} : 100\frac{5}{16}$; showing a gain of $\frac{5}{16}$ p. c. *Ans.*

(13) Given $13167 = 104\frac{1}{2}$ hundredths of the former population, to find what population would be $95\frac{1}{2}$ hundredths of it:

$104\frac{1}{2} : 95\frac{1}{2} :: 13167 : 12033$ *Ans.*

(14) Given £28 12*s.* $=110$ hundredths of the prime cost, to find what price would be $112\frac{1}{2}$ hundredths of it:

$110 : 112\frac{1}{2} ::$ £28 12*s.* : £29 5*s.* *Ans.*

(15) Given A's share, $\frac{1}{5}$, $= \frac{108}{100}$ of B's, to find B's share:

$\frac{1}{5} \div \frac{108}{100} = 20 \div 108 = \frac{5}{27}$, B's share. *Ans.*

Also, given A's share, $\frac{1}{5}$, $= \frac{92}{100}$ of C's, to find C's:

$\frac{1}{5} \div \frac{92}{100} = 20 \div 92 = \frac{5}{23}$, C's share. *Ans.*

(16) Given $\frac{126s.}{37}$ per yard$=96\frac{1}{4}$ hundredths of the prime cost, to find the price per yard that would be$=102\frac{7}{9}$ hundredths of it:

$96\frac{1}{4} : 102\frac{7}{9} :: \frac{126s.}{37} : \frac{40s.}{11}$ per yd.

and the no. of yards which, at that price, would amount to 40*s.* is $40s. \div \frac{40s.}{11} = 11$ yds. *Ans.*

(17) Here, the inquiry is—What sum diminished by a payment of $4\frac{1}{8}$ per cent. will leave £980? or—Of what quantity will the value of $95\frac{7}{8}$ per cent. be £980?

$95\frac{7}{8} : 100 :: £980 : £1022\ 3s.\ 3\frac{327}{767}d.$ *Ans.*

(18) $2\frac{1}{2}$ *guin.* $= £\frac{5}{2} \times \frac{21}{20} = £2\frac{5}{8}$;

$97\frac{3}{8} : 2\frac{5}{8} :: £1520 : £40\ 19s.\ 6\frac{6}{41}d.$ *Ans.*

SIMPLE INTEREST.

Ex. 62.

(1) 5 per cent. per annum for 2 years is 2 times 5, or 10 per cent.; $\frac{10}{100}$ or $\frac{1}{10}$ of £5 = 10*s.* *Ans.*

(2) 3 times 4 per cent. or $\frac{12}{100}$ of £325 = £39 *Ans.*

(3) $\frac{3\frac{1}{2}}{100}$ of £350 = $\frac{7}{100}$ of £175 = £12·25 = £12 5*s.* *Ans.*

(4) 3 times 3 p. c. = $\frac{9}{100}$ of £292 10*s.* = £26 6*s.* 6*d.* *Ans.*

(5) 4 times $2\frac{1}{2}$ p. c. = $\frac{10}{100}$ or $\frac{1}{10}$ of £174 5*s.* 5*d.* = £17 8*s.* $6\frac{1}{2}d.$ *Ans.*

(6) 5 times $3\frac{1}{8}$ p. c. $= \frac{3\frac{1}{8} \times 5}{100} = \frac{10 \times 5}{300} = \frac{1}{6}$ of £1000 will be the interest; or $1\frac{1}{6}$ of £1000 = £1166 13*s.* 4*d.* the amount. *Ans.*

(7) $2\frac{1}{2}$ times 5 p. c. $= \frac{5 \times 2\frac{1}{2}}{100} = \frac{25}{200} = \frac{1}{8}$ of £782 18*s.* 4*d.* will be the interest; or $1\frac{1}{8}$ of £782 18*s.* 4*d.* = £880 15*s.* $7\frac{1}{2}d.$ the amt *Ans.*

(8) $\frac{3\frac{3}{8}}{100}$ or $\frac{27}{800}$ of £63 17*s.* 2*d.* = £2 3*s.* $1\frac{101}{400}d.$ the interest; which added to the principal gives £66 0*s.* $3\frac{101}{400}d.$ the amt. *Ans.*

(9) $\frac{1}{2}$ of $4\frac{1}{7}$ p. c. $= \frac{2\frac{1}{14}}{100}$ or $\frac{29}{1400}$ of £1240 = £25 13*s.* $8\frac{4}{7}d.$ int.
£1265 13*s.* $8\frac{4}{7}d.$ amt. } *Ans.*

(10) $\frac{8}{12}$ of 4 p. c.$=\frac{1}{100}$ of £178 8*s.* 9*d.*$=$£1 15*s.* $8\frac{1}{4}$*d.* int.
£180 4*s.* $5\frac{1}{4}$*d.* amt. } *Ans.*

(11) $\frac{8}{12}$ of $2\frac{1}{4}$ p. c.$=\frac{1\frac{1}{2}}{100}$ of £365 7*s.* 6*d.*$=$£5 9*s.* $7\frac{7}{20}$*d.* int.
£370 17*s.* $1\frac{13}{20}$*d.* amt. } *Ans.*

(12) $3\frac{1}{2}$ times 5 p. c.$=\frac{17\frac{1}{2}}{100}$ or $\frac{7}{40}$ of £51 16*s.* 4*d.*$=$£9 1*s.* $4\frac{3}{10}$*d.* int.
£60 17*s.* $8\frac{3}{10}$*d.* amt.
Ans.

(13) $1\frac{5}{12}$ times $2\frac{1}{2}$ p. c.$=\frac{2\frac{1}{2}\times17}{100\times12}=\frac{17}{480}$ of £742 12*s.* 6*d.*

$\frac{16}{480}=\frac{1}{30}=$	24	15	1
$\frac{1}{480}=\frac{1}{16}=$	1	10	$11\frac{5}{16}$
£226	6	$0\frac{5}{16}$	int.
£768	18	$6\frac{5}{16}$	amt.

Ans.

(14) $5\frac{10}{12}$ times 3 p. c.$=\frac{17\frac{1}{2}}{100}$ or $\frac{7}{40}$ of £10375$=$£1815 12*s.* 6*d.*
£12190 12*s.* 6*d.* } *Ans.*

(15) $3\frac{4}{12}$ times $3\frac{1}{3}$ p.c.$=\frac{3\frac{1}{3}\times3\frac{1}{3}}{100}=\frac{1}{9}$ of £987 14*s.* 7*d.*$=$£109 14*s.* $11\frac{4}{9}$*d.*
£1097 9*s.* $6\frac{4}{9}$*d.*
Ans.

(16) $\frac{30}{365}$ of $3\frac{1}{2}$ hundredths$=\frac{21}{7300}$ of £320$=$18*s.* $4\frac{68}{73}$*d.* *Ans.*

(17) $\frac{146}{365}$ of $5\frac{1}{4}$ hundredths$=\frac{21}{1000}$ of £230 10*s.* 6*d.*$=$£4 16*s.* 9·846*d.*
Ans.

(18) $\frac{84}{365}$ of 4 hundredths$=\frac{84}{9125}$ of £1730$=$£15 18*s.* $6\frac{42}{365}$*d.* *Ans.*

(19) From 10th March to 10th July are 122 days;
$\frac{122}{365}$ of $6\frac{1}{2}$ hundredths$=\frac{793}{36500}$ of £503 14*s.*$=$£10 18*s.* 10·416*d.*
Ans.

(20) From 16th April to 2nd Oct. are 169 days;
$\frac{169}{365}$ of $4\frac{1}{8}$ hundredths$=\frac{5577}{292000}$ of £168 18*s.* 3*d.*$=\frac{£942025\ 0s.\ 3d.}{202000}$
$=$£3 4*s.* $6\frac{78003}{292000}$*d.* *Ans.*

(21) From 16th Jan. 1865 to 13th April 1866$=$1 year 87 days;
$1\frac{87}{365}$ of $3\frac{1}{4}$ hundredths$=\frac{452\times13}{365\times400}$ of £4891$=\frac{£67\times113\times13}{500}$
$=$£196·846$=$£196 16*s.* 11·04*d.* *Ans.*

(22) From 23rd Oct. 1863 to 7th Sept. following=320 days;
$\frac{320}{365}$ of 5 hundredths=$\frac{16}{365}$ of £270 15*s.* 8*d.*
= 11 17 $4\frac{289}{365}$*d.* int.
£282 13*s.* $0\frac{288}{365}$*d.* *Ans.*

(23) $1\frac{319}{365}$ of 4·35 hundredths=$\frac{696}{10000}$ of £489 5*s.* 11*d.*
=£340549 18*s.*÷10000=£34 1*s.* 1·1976*d.* *Ans.*

(24) $2\frac{270}{365}$ of 2·7 hundredths=$\frac{27}{365}$ of £5326 13*s.* 6*d.*=£394 0*s.* $6\frac{264}{365}$*d.*
Ans.

Ex. 63.

(1) The given interest is $\frac{117}{390}=\frac{3}{10}$ of the principal for 6 years, or $\frac{1}{6}$ of $\frac{3}{10}$ of it for 1 year; $\therefore$ $\frac{1}{6}$ of $\frac{3}{10}$ of 100=5 p. c. *Ans.*

(2) £715 12*s.* 6*d.* : £53 13*s.* $5\frac{1}{4}$*d.* :: 100 : $7\frac{1}{2}$=the int. on 100, which is $\frac{7\frac{1}{2}}{2\frac{1}{2}}$ of the annual rate=3 years. *Ans.*

(3) £530 : £12 7*s.* 4*d.* :: 100 : $\frac{2968\times100}{530\times20\times12}=2\frac{1}{3}$=the int. on 100, which is $\frac{2\frac{1}{3}}{4}$ of the annual rate=$\frac{7}{12}$ of a yr.=7 months.
Ans.

(4) The given int. is $\frac{£1\ 2s.\ 2\frac{1}{4}d.}{£76\ 0s.\ 10d.}=\frac{1065}{73000}=\frac{213}{14600}$ of the principal for $\frac{142}{365}$ of a year, or $\frac{213}{14600}\div\frac{142}{365}=\frac{3}{80}$ of it for 1 year; and $\frac{3}{80}$ of 100=$3\frac{3}{4}$ per cent. *Ans.*

(5) The given per cent. is, in all, $2\frac{1}{4}\times2\frac{1}{2}$, or $5\frac{5}{8}$ per cent.; and we ask—Of what sum will £92 16*s.* 3*d.* be the value of $5\frac{5}{8}$ per cent.?
$5\frac{5}{8}$: 100 :: £92 16*s.* 3*d.*
or, 45 : 100 :: £742 10*s.* : £1650 *Ans.*

(6) $8\frac{1}{9}\times\frac{105}{365}$: 100 :: £17 3*s.* : £$17\frac{3}{20}\times100\times\frac{3}{7}$=£735 *Ans.*

(7) £269 16*s.* : 18*s.* $9\frac{1}{2}$*d.* :: 100 : $\frac{11275}{82376}$=the int. on 100, which is $\frac{11275}{82376}\div4\frac{1}{2}$, or $\frac{11275}{145692}$ of the annual rate; $\frac{11275}{145692}$ of 365 da. =28 da. nearly. *Ans.*

(8) This is equivalent to the inquiry—What sum increased by 3 times $3\frac{1}{2}$ per cent. will amount to £1355 9*s.* 4*d.* ?

$\frac{110\frac{1}{2}}{100}$ of the required sum = £1355 9*s.* 4*d.*;

$110\frac{1}{2} : 100 ::$ £1355 9*s.* 4*d.* : £1226 13*s.* 4*d.* *Ans.*

(9) $104\frac{1}{2} : 100 ::$ £8 10*s.* $8\frac{1}{5}$*d.* : £8 3*s.* 4*d.* *Ans.*

(10) $\frac{292}{365}$ of $3\frac{1}{4} = \frac{4}{5}$ of $\frac{13}{4} = 2\frac{3}{5}$;

$102\frac{3}{5} : 100 ::$ £893 2*s.* $7\frac{23}{25}$*d.* : £870 10*s.* *Ans.*

(11) The inquiry here is—In what time will £100 principal produce £100 interest, at $2\frac{1}{4}$ per cent. ?

The int. on 100 is therefore $\frac{100}{2\frac{1}{4}}$ of the annual rate $= \frac{400}{9}$ yrs.

$= 44\frac{4}{9}$ yrs. *Ans.*

(12) $\frac{183}{365}$ of $2\frac{1}{3} = \frac{357}{365}$; $\therefore 100\frac{357}{365} : 100 ::$ 24*s.* $8\frac{7}{8}$*d.*

or, 36857 : 36500 :: 296·875*d.* : 294*d.* nearly

= 24*s.* 6*d.* nearly. *Ans.*

COMPOUND INTEREST.

Ex. 64.

(1) $1{\cdot}03^3 = 1{\cdot}0609$; which × 475 gives £503·9275 = £503 18*s.* $6\frac{3}{5}$*d.* *Ans.*

(2) $1{\cdot}04^3 = 1{\cdot}124864$; which × 1250 gives £1406·08

= £1406 1*s.* $7\frac{1}{5}$*d.* *Ans.*

(3) $1{\cdot}05^4 = 1{\cdot}21550625$; which × 680 = £826·54425

= £826 10*s.* 10·62*d.* *Ans.*

(4) $1{\cdot}025^3 = 1{\cdot}076890625$; which × 7000 = £7538·234375

= £7538 4*s.* $8\frac{1}{4}$*d.* *Ans.*

(5) $1{\cdot}05^4 \times 80\frac{5}{6} = 1{\cdot}21550625 \times \frac{485}{6} =$ £98·253421875

= £98 5*s.* 0·82125*d.* *Ans.*

(6) $1{\cdot}035^2 \times 1781\frac{2}{3} = 1{\cdot}071225 \times 1781\frac{2}{3} =$ £1908·565875

= £1908 11*s.* 3·81*d.* *Ans.*

(7) $1{\cdot}05^5 = 1{\cdot}27628156$ nearly;

$\therefore$ £293 13*s.* 6*d.* is to be $\times$ ·27628156

293

6*s.* 8*d.* = $\frac{1}{3}$ of £1	80·950497
6*s.* 8*d.* = $\frac{1}{3}$ of £1	·092094
0*s.* 2*d.* = $\frac{1}{40}$ of 80*d.*	·092094
	·002302

£81·136987 = £81 2*s.* $8\frac{7}{8}$*d.* nearly. *Ans.*

(8) $1{\cdot}045^3 = 1{\cdot}14116612$ nearly;

$\therefore$ £1365 9*s.* 2*d.* is to be $\times$ ·14116612

1365

6*s.* 8*d.* = $\frac{1}{3}$ of £1	192·691754
2*s.* 6*d.* = $\frac{1}{8}$ of £1	·047055
	·017646

£192·756455 = £192 15*s.* 1·55*d.* nearly. *Ans.*

(9) $1{\cdot}0225^4 = 1{\cdot}09308332$ nearly;

$\therefore$ ·09308332 is to be $\times$ 567

567

£52·778242 = £52 15*s.* 6·778*d.* nearly. *Ans.*

(10) $\frac{103\frac{1}{3}}{100} = \frac{31}{30}$; and $\left(\frac{31}{30}\right)^6 = \frac{887503681}{9\times9\times9000000} = 1{\cdot}21742617$ nearly;

$\therefore$ £2763 8*s.* 4*d.* is to be $\times$ ·21742617

2763

	£600·748508
5*s.* 0*d.* = $\frac{1}{4}$ of £1	·054357
3*s.* 4*d.* = $\frac{1}{6}$ of £1	·036238
	£600·839103

= £600 16*s.* 9·38*d.* nearly. *Ans.*

Ex. 65.

(1) 3 per cent. per annum for 2 yrs., payable half-yearly, is 1·5 per cent. per half-year for 4 half-years;

$1{\cdot}015^4 = 1{\cdot}06136355$ nearly;

$\therefore$ ·06136355 $\times$ 1340 = £82·227157 = £82 4*s.* $6\frac{1}{2}$*d.* nearly. *Ans.*

(2) 4 per cent. per annum for $1\frac{1}{2}$ yr., payable quarterly, is 1 per cent. per quarter for 6 quarters.

$1{\cdot}01^6 = 1{\cdot}06152015$ nearly;

$\therefore 1{\cdot}06152015 \times 630 = £668{\cdot}75769 = £668\ 15s.\ 1{\cdot}85d.$ nearly. *Ans.*

(3) $103\frac{3}{4} \div 100 = \frac{83}{80}$, the cube of which is $\frac{571787}{512000}$; and this multiplied by the required no. of £s would produce £491 7*s.* 7*d.* or £491·37916̇;

$\therefore$ £491·37916̇ $\div \frac{571787}{512000} =$ £440 nearly. *Ans.*

(4) $102\frac{1}{2} \div 100 = \frac{41}{40}$, the fourth power of which diminished by unity gives $\frac{265761}{2560000}$ of the required principal = £127 18*s.* $6\frac{7}{40}d.$;

$\therefore$ 265761 times the required principal = $£327489866\frac{2}{3}$;

or, the principal = £1232 5*s.* 5·305*d.* nearly. *Ans.*

(5) $1{\cdot}05^7 = 1{\cdot}4071$ nearly; and £254·4375 ÷ ·4071 = £625 *Ans.*

TRUE DISCOUNT.

Ex. 66.

(1) The int. on 100 for 12 months is 6; therefore 100 is the present worth of 106; or, the present worth is $\frac{100}{106}$ or $\frac{50}{53}$ of the future payment; hence, $\frac{50}{53}$ of £583 = £11 × 50 = £550 *Ans.*

(2) Int. on 100 for 7 mths. = $\frac{7}{12}$ of $3\frac{1}{8} = 1\frac{79}{96}$, which is therefore the discount on $101\frac{79}{96}$; or 175 is the disc. on 9775; or 7 is the disc. on 391; or the disc. is $\frac{7}{391}$ of the future payment; hence, $\frac{7}{391}$ of £1150 = $\frac{7}{17}$ of £50 = $£20\frac{10}{17}$ *Ans.*

(3) Int. on 100 for $1\frac{3}{4}$ yrs. = $5 \times 1\frac{3}{4} = 8\frac{3}{4}$; therefore $8\frac{3}{4}$ is the discount on $108\frac{3}{4}$; or 35 on 435; or 7 on 87; hence, $\frac{7}{87}$ of £98 19*s.* 3*d.* = £7 19*s.* 3*d.* *Ans.*

(4) Int. on $100 = 4\frac{1}{4} \times 3 = 12\frac{3}{4}$; therefore 100 is the pres. worth of $112\frac{3}{4}$; or 400 is that of 451; hence, $\frac{400}{451}$ of $£675\frac{1}{8} = £598\frac{32}{41}$ *Ans.*

(5) Int. on 100 for 6 mths.$=\frac{1}{2}$ of $3\frac{1}{4}=1\frac{5}{8}$; therefore 100 is the pres. worth of $101\frac{5}{8}$; or 800 is that of 813; hence, $\frac{800}{813}$ of £$474\frac{5}{8}$=£$467\frac{29}{813}$ *Ans.*

(6) Int. on 100 for 4 mths.$=\frac{1}{3}$ of $2\frac{1}{2}=\frac{5}{6}$, which is therefore the disc. on $100\frac{5}{6}$; or 5 is that on 605; or 1 on 121; hence, $\frac{1}{121}$ of £243 15*s.* 9*d.*=£2 0*s.* $3\frac{6}{11}$*d.* *Ans.*

(7) Int. on 100 for 5 mths.$=\frac{5}{12}$ of $2\frac{7}{8}=1\frac{19}{96}$; therefore 100 is the pres. worth of $101\frac{19}{96}$; or 9600 is that of 9715; or 1920 is that of 1943; hence, $\frac{1920}{1943}$ of £8700$=\frac{1920}{67}$ of £300=£$8597\frac{1}{67}$ *Ans.*

(8) Int. on 100 for 17 mths.$=\frac{17}{12}$ of $4\frac{1}{2}=6\frac{3}{6}$, which is therefore the disc. on $106\frac{3}{6}$; or 51 is the disc. on 851; hence, $\frac{51}{851}$ of £555 $=\frac{51}{23}$ of £15=£$33\frac{6}{23}$ *Ans.*

(9) Int. on 100$=\frac{296}{365}$ of $3\frac{1}{2}=2\frac{306}{365}$; therefore 100 is the pres. worth of $102\frac{306}{365}$; or 9125 is that of 9384; hence, $\frac{9125}{9384}$ of £357$=\frac{9125}{184}$ of £7=£$347\frac{27}{184}$ *Ans.*

(10) From Dec. 28 to Jan. 25 are 28 days. Int. on 100 for 28 days $=\frac{28}{365}$ of $5=\frac{28}{73}$; therefore 100 is the cash value of $100\frac{28}{73}$; or 1825 is that of 1832; hence, $\frac{1825}{1832}$ of £$114\frac{1}{2}=\frac{£1825}{16}$

=£114 1*s.* 3*d.* *Ans.*

(11) Here 100 must be $\frac{£25\ 12s.}{£26\ 16s.}$ or $\frac{64}{67}$ of its future amount; therefore that future amount is$=6700\div64=104\frac{11}{16}$; and therefore $4\frac{11}{16}$ must be the int. on 100 for the time sought; hence,

$6\frac{1}{4}$: $4\frac{11}{16}$ :: 12 mths. : 9 mths. *Ans.*

(12) Int. on 100 for 4 mths.$=\frac{1}{3}$ of $4=1\frac{1}{3}$; therefore 100 is the pres. worth of $101\frac{1}{3}$; or 75 is that of 76; hence the pres. worth of 19*s.* is $\frac{75}{76}$ of 19*s.*$=18\frac{3}{4}$*s.*

Int. on 100 for 1 mth.$=\frac{1}{12}$ of $4=\frac{1}{3}$; therefore 100 is the pres. worth of $100\frac{1}{3}$; or 300 is that of 301; hence the pres. worth of 21*s.* 6*d.* is $\frac{300}{301}$ of 258*d.*$=\frac{300}{7}$ of 6*d.*$=21\frac{3}{7}$*s.*

Hence, $18\frac{3}{4}$: $21\frac{3}{7}$,

or, 75×7 : 150×4 :: 100 : $\frac{800}{7}=114\frac{2}{7}$, showing an immediate gain of $14\frac{2}{7}$ p. c. *Ans.*

(13) Int. on 100 for 44 days$=\frac{44}{365}$ of $5=\frac{44}{73}$; therefore 100 is the pres. worth of $100\frac{44}{73}$; or 1825 is that of 1836; and therefore the pres. worth of 1*s.* 5*d.* is $\frac{1825}{1836}$ of $17d.=\frac{1825}{108}d.=16\frac{97}{108}d.$

Hence, $16\frac{97}{108} : 18\frac{1}{4}d.$

or, $1825 : 73\times27 :: 100 : 108$, showing an immediate gain of 8 per cent. *Ans.*

(14) Int. on 100 for 6 mths.$=\frac{1}{2}$ of $5=2\frac{1}{2}$; therefore 100 is the pres. worth of $102\frac{1}{2}$; or 40 is that of 41; hence the cash value of the selling price is $\frac{40}{41}$ of $61\frac{1}{2}s.=60s.$, which is an advance of 6*s.* on the original cost:—$54s. : 6s. :: 100 : 11\frac{1}{9}$ per cent.; but, at the time of selling, the original cost had suffered a loss of 2 mths. int.$=\frac{1}{6}$ of $5=\frac{5}{6}$ per cent.; hence, $11\frac{1}{9}-\frac{5}{6}=10\frac{5}{18}$ per cent. trade profit. *Ans.*

(15) Int. on 100 for 7 mths.$=\frac{7}{12}$ of $5=2\frac{11}{12}$, which makes 100 to be the pres. worth of $102\frac{11}{12}$, or 240 that of 247; hence the pres. worth of 4*s.* 9*d.*$=\frac{240}{247}$ of $57d.=\frac{240}{13}$ of $3d.=\frac{720d.}{13}$, the cash prime cost;

$100 : 108\frac{1}{3}$ [or 12 : 13] $:: \frac{720d.}{13} : 5s.$, the cash selling price;

therefore $5s.\ 2d.-5s.=2d.$ is the int. on 5*s.* for the time sought; or the int. on 300 is 10; or that on 100 is $3\frac{1}{3}$;

$5 : 3\frac{1}{3} ::$ 12 mths. : 8 mths. *Ans.*

MERCANTILE DISCOUNT.

Ex. 67.

(1)

Amount per invoice £428	17*s.*	6*d.*	
Disc. 5 p. c. $=\frac{1}{20}=$ 21	8	$10\frac{1}{2}$	
Cash paid	407	8	$7\frac{1}{2}$ *Ans.*

(2) Bill due Aug. 15th; discounted June 26th, or 50 days before due; 50 days' int. on £723⅔=£723⅔×$\frac{50}{365}$ of $\frac{4\frac{1}{2}}{100}$
=£32565÷7300=£4 9*s.* 2½*d.*, the discount;

Amt. of the bill £723	13*s.*	4*d.*
Discount	4	9	2½
Cash proceeds	719	4	1½ *Ans.*

(3) Bill due Nov. 21st; discounted Nov. 1st, or 20 days before due; 20 days' int. on £232 15*s.*=4655*s.*×$\frac{20}{365}$ of $\frac{5}{100}$
=4655*s.*÷365=12*s.* 9*d. Ans.*

(4) Bill due June 2nd; discounted Jan. 15th, or 138 days before due; 138 days' int. on £1125=£1125×$\frac{138}{365}$ of $\frac{6}{100}$=£1863÷73
=£25 10*s.* 5*d.*

Amt. of the bill £1125	0*s.*	0*d.*
Discount	25	10	5
Cash proceeds	1099	9	7 *Ans.*

(5) Bill due May 3rd; discounted April 6th, or 27 days before due;

Amt. of the bill	£2000	0*s.*	0*d.*
27 da. int. on £2000=£540÷73=	7	7	11¼
Cash proceeds	1992	12	0¾ *Ans.*

Again; 27 da. int. on 100=$\frac{27}{365}$ of 5=$\frac{27}{73}$; so that the true disc. is at the rate of $\frac{27}{73}$ on 100$\frac{27}{73}$, or 27 on 7327;

Banker's disc.	=£7	7*s.*	11¼*d.*
True disc.=£2000×27÷7327=	7	7	4¾
Banker's gain	= 0	0	6½ *Ans.*

SIMPLE DISTRIBUTIVE PROPORTION.

Ex. 68.

(1) The less no. is to the greater as 1 : 5; 1+5=6; and hence $\frac{1}{6}$ and $\frac{5}{6}$ of 54=9 and 45 *Ans.*

(2) 2+3+4=9; hence, $\frac{2}{9}$, $\frac{3}{9}$, and $\frac{4}{9}$ of 54=12, 18, 24 *Ans.*

(3) $\frac{1}{4}$, $\frac{1}{7}$, $\frac{1}{10}=\frac{35}{140}$, $\frac{20}{140}$, $\frac{14}{140}$; so that the sums required are as 35, 20, and 14; sum, 69; hence, $\frac{92s.}{69}$, or $\frac{4s.}{3}$ multiplied by 35, 20, and 14 severally, gives 46*s.* 8*d.*, 26*s.* 8*d.*, 18*s.* 8*d.* *Ans.*

(4) Here, $7\frac{1}{2}$ is to $10\frac{1}{2}$ as 15 to 21, or as 5 to 7; sum, 12; hence, $\frac{5}{12}$ and $\frac{7}{12}$ of $2\frac{1}{2}s.=2\frac{1}{2}d.$ multiplied by 5 and $7=12\frac{1}{2}d.$ to *A*, $17\frac{1}{2}d.$ to *B*. *Ans.*

(5) The shares are as 80, 35, and 93; sum, 208; hence, $\frac{£260}{208}$, or $\frac{£5}{4}$, $\times$ 80, 35, and 93, gives for *A* £100, *B* £43 15*s.*, *C* £116 5*s.* *Ans.*

(6) *C*'s share will be 1 sum, *B*'s$=\frac{1}{5}$ of that sum, *A*'s$=\frac{3}{5}$ of it; or, the shares of *A*, *B*, *C* will be as 3, 1, and 5; sum, 9; hence, $\frac{3}{9}$, $\frac{1}{9}$, and $\frac{5}{9}$ of £40=£13 6*s.* 8*d.* to *A*, £4 8*s.* $10\frac{2}{3}d.$ to *B*, £22 4*s.* $5\frac{1}{3}d.$ to *C*. *Ans.*

(7) The 21 miles is divided between *A* and *B* into distances proportioned as $3\frac{3}{4}$: 5, or as 15 : 20, or as 3 : 4; sum, 7; hence, $\frac{3}{7}$ and $\frac{4}{7}$ of 21 mi. gives for *A* 9 mi., *B* 12 mi. *Ans.*

(8) The load in the 1st is$=\frac{12}{10}$ or $\frac{6}{5}$ of that in the 2nd; and that in the 2nd is$=\frac{15}{12}$ or $\frac{5}{4}$ of that in the 3rd. If, therefore, the 3rd be regarded as containing 4 equal weights, the load in the second is=5 of these weights, and that in the 1st=6; sum, 15; hence, $\frac{6}{15}$, $\frac{5}{15}$, and $\frac{4}{15}$ of 195 cwt.=78, 65, and 52 cwt. *Ans.*

(9) *A*'s share is to *B*'s as 5 to 7; sum, 12; hence, *A* should get $\frac{5}{12}$, and *B* $\frac{7}{12}$ of £460 16*s.*=£192 and £268 16*s.* *Ans.*

(10) Regarding *C*'s share as composed of 5 equal parts, *B*'s will be=6 of these parts, *A*'s=12, *D*'s=12+5=17; sum, 40; hence, $\frac{240d.}{40}$, or 6*d.*, $\times$ 12, 6, 5, 17, gives *A* 6*s.*, *B* 3*s.*, *C* 2*s.* 6*d.*, *D* 8*s.* 6*d.* *Ans.*

(11) The men are in number $\frac{5}{2}$ of the children, and the children $\frac{3}{7}$ of the women; hence, if the proportion of women be called 7, that of the children will be 3, and that of the men $\frac{5}{2}$ of 3,

or $7\frac{1}{2}$; that is, the nos. of men, women, and children are as $7\frac{1}{2}$, 7, and 3, or as 15, 14, and 6; sum, 35; hence, $\frac{700}{35}$, or 20, × 15, 14, 6, gives 300 men, 280 women, and 120 children. *Ans.*

(12) Calling *C*'s proportion 34, *D*'s will be 65, *B*'s $1\frac{1}{2}$ of 34=51, *A*'s $\frac{10}{17}$ of 51=30; or, the capitals of *A*, *B*, *C*, *D* are as 30, 51, 34, and 65; sum, 180; hence, $\frac{£12600}{180}$, or £70, × 30, 51, 34, 65, gives *A* £2100, *B* £3570, *C* £2380, *D* £4550 *Ans.*

(13) The 1st sum is=$\frac{107}{100}$ of the 2nd, and the 2nd is=$\frac{97}{100}$ of the 3rd; therefore, if the 3rd be represented by 100, the 2nd will be 97, and the 1st will be $\frac{107}{100}$ of 97=103·79; or, the three sums are as 10379, 9700, and 10000; sum, 30079; hence, $\frac{8594s.}{30079}$, or $\frac{2s.}{7}$ × 10379, 9700, 10000, gives £148 5*s.* $5\frac{1}{7}$*d.*, £138 11*s.* $5\frac{1}{7}$*d.*, £142 17*s.* $1\frac{5}{7}$*d. Ans.*

(14) The 1st is $\frac{5}{2}$ of the 2nd; and since 5 times the second is=$\frac{24}{100}$ of the 3rd, or 500 times the 2nd=24 times the third, therefore the 2nd is $\frac{24}{500}$ or $\frac{6}{125}$ of the third; and thus, if 125 be taken as the proportionate no. for the 3rd, 6 will be that for the 2nd, and $\frac{5}{2}$ of 6, or 15, will be that for the 1st; or, the three parts are as 15, 6, and 125; sum, 146; hence, $\frac{365}{146}$, or $\frac{5}{2}$, × 15, 6, 125, gives $37\frac{1}{2}$, 15, $312\frac{1}{2}$. *Ans.*

(15) If the proportionate no. for the 1st be 8, that for the 2nd is 5, and that for the 3rd is $\frac{6}{7}$ of 5=$4\frac{2}{7}$; or, the three parts are as 56, 35, and 30; sum, 121; hence, the 1st exceeds the 3rd by $\frac{26}{121}$ of the whole, which excess, by the question, is=$6\frac{1}{2}$ sq. yds.; therefore the whole must be=$6\frac{1}{2}$ sq. yds. ÷ $\frac{26}{121}$=$\frac{13}{2}$ × $\frac{121}{26}$ or $30\frac{1}{4}$ sq. yds., or 1 sq. po. *Ans.*

COMPOUND DISTRIBUTIVE PROPORTION.

Ex. 69.

(1) A woman's share is $=\frac{8}{13}$ of a man's, and a child's $=\frac{7}{12}$ of a woman's; so that, if 13 be the proportionate no. for a man's share, a woman's will be 8, and a child's $\frac{7}{12}$ of $8=4\frac{2}{3}$; or, the shares of a man, woman, and child are as 39, 24, and 14; hence the proportionate shares of 4 men, 5 women, and 7 children will be 39×4, 24×5, 14×7, or 156, 120, 98; sum, 374; accordingly, each man's share will be $\frac{1}{4}$ of $\frac{156}{374}$, or $\frac{39}{374}$, of the whole, viz. $\frac{137\frac{1}{2}s.}{374}\times39=\frac{25s.}{68}\times39=14s.\ 4\frac{1}{17}d.$, whence, each woman's $=8s.\ 9\frac{15}{17}d.$, and each child's $=5s.\ 1\frac{13}{17}d.$ *Ans.*

(2) $2\frac{1}{2}\times2$, $3\times2\frac{1}{2}$, 4×3, $4\frac{1}{2}\times3\frac{1}{2}$, give 5, $7\frac{1}{2}$, 12, and $15\frac{3}{4}$ hundredths, which are as 20, 30, 48, and 63; therefore, the four sums are to be such that, if multiplied respectively by 20, 30, 48, 63, or divided respectively by $\frac{1}{20}$, $\frac{1}{30}$, $\frac{1}{48}$, $\frac{1}{63}$, the results shall be equal; the sums, therefore, will be in proportion to each other as these fractions, or as their numerators corresponding to the common denominator 5040, viz. as 252, 168, 105, and 80; sum, 605. The sums required, therefore, are $\frac{£423{\cdot}5}{605}$, or $\cdot7,\times252$, 168, 105, 80, or £176 8*s.*, £117 12*s.*, £73 10*s.*, £56 *Ans.*

(3) The int. on the 1st part is to that on the 2nd as $\frac{7}{10}$ to 1; and that on the 2nd is to that on the 3rd as 1 to $\frac{13}{6}$; so that the three interests are as $\frac{7}{10}$, 1, and $\frac{13}{6}$, or as 21, 30, and 65. Now, these interests are at the respective rates of 3, 4, and $2\frac{1}{2}$ per cent.; therefore, the three required sums are as $21\div3$, $30\div4$, $65\div2\frac{1}{2}$; or as 7, $7\frac{1}{2}$, 26; or as 14, 15, 52; sum, 81. Hence, $\frac{14}{81}$, $\frac{15}{81}$, $\frac{52}{81}$ of £100 $=$ £$17\frac{23}{81}$, £$18\frac{14}{27}$, £$64\frac{16}{81}$ *Ans.*

(4) A's 25 oxen for 20 da. = 500 oxen for 1 day,
6
19 " " 30 " = 570 " "
8
27 " " 34 " = 918 " "
A's whole benefit = 1988 oxen for 1 day.

B's 18 oxen for 21 da. = 378 oxen for 1 day,
7
25 " " 43 " = 1075 " "
16
9 " " 20 " = 180 " "
B's whole benefit = 1633 oxen for 1 day.

Therefore, the payments by A and B should be as 1988 to 1633, or as 28 to 23; sum, 51; hence, $\frac{28}{51}$ and $\frac{23}{51}$ of 12 times £$2\frac{5}{6}$ gives £$18\frac{2}{3}$ for A, £$15\frac{1}{3}$ for B. *Ans.*

(5) A's £350 for 9 months = £3150 for 1 month,
B's £680 " 7 " = 4760 " "
7910
hence, A should have $\frac{315}{791}$ or $\frac{45}{113}$ of £140 = £$55\frac{85}{113}$
B " " $\frac{476}{791}$ or $\frac{68}{113}$ of £140 = £$84\frac{28}{113}$ } *Ans.*

(6) A's £3000 for 12 months = £36000 for 1 month,
B's £2000 " 5 " = 10000 " "
C's £1580 " 5 " = 7900 " "
53900
hence, A should have $\frac{360}{539}$ of £500 = £$333\frac{513}{539}$
B " " $\frac{100}{539}$ of £500 = $92\frac{412}{539}$
C " " $\frac{79}{539}$ of £500 = $73\frac{153}{539}$ } *Ans.*

(7) Pure gold being 24 carats fine, we have
34 oz. × $\frac{16}{24}$ = $22\frac{2}{3}$ oz. pure gold,
42 " × $\frac{18}{24}$ = $31\frac{1}{2}$ " "
In 76 oz. of the compound are $54\frac{1}{6}$ oz. pure gold;
therefore, in each oz. of the compound there is $\frac{54\frac{1}{6}}{76}$ or $\frac{325}{76\times6}$
of an oz. pure; hence, $\frac{325}{76\times6}\times38=\frac{325 \text{ oz.}}{12}$
= 27 oz. 1 dwt. 16 grs. *Ans.*

(8) 5 per cent. on $\frac{3}{5}$ = 3 p. c. on the whole,
6 " " $\frac{1}{6}$ = 1 " "
7 " " $\frac{7}{30}$ = $1\frac{19}{30}$ " "
together = $5\frac{19}{30}$ p. c. profit on the whole;
$\therefore 5\frac{19}{30} - 5\frac{1}{2}$ or $\frac{2}{15}$ per cent. on the prime cost = £2; or 2 hundredths of the prime cost = £30; $\therefore$ £30 ÷ $\frac{2}{100}$ = £1500 *Ans.*

(9) The stocks are in the proportion of the losses per month, or as $113\frac{19}{34} \div 13\frac{1}{2}$, $82\frac{6}{17} \div 8$, and $145\frac{10}{17} \div 10$, which are as 286, 350, and 495; sum, 1131; therefore, $\frac{£1885}{1131}$, or $\frac{£5}{3}$, × 286, 350, 495, gives for *A* £476$\frac{2}{3}$, *B* £583$\frac{1}{3}$, *C* £825 *Ans.*

(10) The proportions of the periods of investment will be as the profits per £ of investment, which are £50 3*s.* $1\frac{1}{2}$*d.* ÷ 1070, £101 13*s.* $5\frac{1}{4}$*d.* ÷ 1205, and £121 3*s.* $5\frac{1}{4}$*d.* ÷ 1175, = 45, 81, and 99 *farthings*, and these are as 5, 9, 11, which shows that *A*'s period is $\frac{5}{11-5}$ or $\frac{5}{6}$ of the excess of *C*'s period beyond *A*'s, that is, $\frac{5}{6}$ of 8 months = $2\frac{1}{2}$ months; whence, also, *B*'s = $\frac{9}{5}$ of $2\frac{1}{2}$ = $4\frac{1}{2}$ months, and *C*'s = $\frac{11}{5}$ of $2\frac{1}{2}$ = $5\frac{1}{2}$ months. *Ans.*

(11) The women being $\frac{36}{100}$ or $\frac{9}{25}$ of the whole no. of persons, the men and boys are together $\frac{16}{25}$ of the whole no.; so that, if we take 9 as a proportional no. for the women, that for the men and boys together will be 16; then, there being 10 boys for every 3 men, we have the proportional no. of boys = $\frac{10}{13}$ of 16 = $\frac{160}{13}$, and that of men = $\frac{3}{13}$ of 16 = $\frac{48}{13}$; or the nos. of men, women, and boys are as $\frac{48}{13}$, 9, and $\frac{160}{13}$, or as 48, 117, 160. Now, the amounts of these proportional nos. calculated at 2*s.* 6*d.*, 1*s.*, and 6*d.* respectively are £6, £5 17*s.*, and £4; sum, £15 17*s.*, which is $\frac{£15\ 17s.}{£47\ 11s.}$ or $\frac{1}{3}$ of the sum given in the question; hence, the actual nos. of men, women, and boys are 3 times (48, 117, and 160), viz. 144 men, 351 women, 480 boys. *Ans.*

(12) For every $\frac{5}{3}$ yd. of the 1st he had 1 yd. of the 2nd, and for 1 yd. of the 2nd he had $\frac{7}{8}$ yd. of the 3rd; therefore, the quantities were as $\frac{5}{3}$, 1, and $\frac{7}{8}$, or as 40, 24, and 21; sum, 85; hence, the quantities were $\frac{40}{85}$, $\frac{24}{85}$, and $\frac{21}{85}$ of

100 yds., and the amounts were as $40\times1\frac{1}{2}$, 24×1, and $21\div\frac{4}{5}$, or as 80, 32, and 35; sum, 147; whence, $\frac{80}{147}$ of £66 3*s.* =720*s.*, the amount paid for the first kind of cloth, viz. for $\frac{40}{85}$ of 100 yds.; and hence, the prices per yard were $720s.\div\frac{4000}{85}$ $=15\frac{3}{10}s.$ for the 1st kind, $15\frac{3}{10}s.\div1\frac{1}{2}=10\frac{1}{5}s.$ for the 2nd, $10\frac{1}{5}s.\div\frac{4}{5}=12\frac{3}{4}s.$ for the 3rd. *Ans.*

STOCKS.

Ex. 70.

(1) $\frac{1833}{78}$ cents=£100$\times\frac{141}{6}$=£2350 *Ans.*

(2) The money to be paid is £115$\frac{1}{2}$ for every cent of stock; hence, £2250 stock being 22$\frac{1}{2}$ cents, we have £115$\frac{1}{2}\times22\frac{1}{2}$ =£2598 15*s.* *Ans.*

(3) Cost of each cent=91$\frac{3}{8}+\frac{1}{8}=91\frac{1}{2}$; and 17 cents at 91$\frac{1}{2}$ =£1555 10*s.* *Ans.*

(4) $\frac{858}{89\frac{3}{8}}$ or $\frac{48}{5}$ cents=£100$\times\frac{48}{5}$=£960 stock. *Ans.*
Also, $\frac{48}{5}$ cents at £3$\frac{3}{4}$=£3$\times$12=£36 income. *Ans.*

(5) Money obtained for each cent=$98-\frac{1}{8}=97\frac{7}{8}$; and as £3240 stock is 32·4 cents, the amount received will be £97$\frac{7}{8}\times32\frac{2}{5}$ =£3171 3*s.* *Ans.*

(6) $\frac{7600}{85\frac{1}{2}}$ cents at £3$\frac{1}{2}=\frac{£7\times7600}{171}=\frac{£7\times400}{9}$=£311 2*s.* 2$\frac{2}{3}$*d.* *Ans.*

(7) $\frac{5166}{102\frac{1}{2}}=\frac{252}{5}$ cents=£100$\times\frac{252}{5}$ or £5040 stock. *Ans.*
Also, $\frac{252}{5}$ cents at £4=£201 12*s.* income. *Ans.*
The third inquiry is—If 4 is yielded from an investment of 102$\frac{1}{2}$, what is the interest per cent.?
102$\frac{1}{2}$: 100 :: 4 : 3$\frac{37}{41}$ per cent. int. *Ans.*

(8) Here, the inquiry is—If 3$\frac{1}{2}$ is yielded from an investment of 82$\frac{1}{4}$, how much is yielded per cent.?
82$\frac{1}{4}$: 100 :: 3$\frac{1}{2}$: 4$\frac{12}{47}$ per cent. *Ans.*

(9) $\frac{8950}{76\frac{1}{2}}$ cents sold out at $78\frac{5}{8}$ realize $\frac{£8950\times78\frac{5}{8}}{76\frac{1}{2}}$, and for every $£89\frac{1}{2}$ in this sum one cent of 4 per cent. stock is obtained; in all, $\frac{8950\times78\frac{5}{8}}{76\frac{1}{2}\times89\frac{1}{2}}$ cents$=\frac{8950\times629}{153\times179\times2}$ cents$=\frac{25\times37}{9}$ cents, or $£10277\frac{7}{9}$ stock. *Ans.*

Also, $\frac{25\times37}{9}$ cents at £4$=\frac{£3700}{9}=£411\ 2s.\ 2\frac{2}{3}d.$ income. *Ans.*

(10) $84\frac{3}{8} : 100 :: 3 : 3\frac{5}{9}$ per cent. *Ans.*

(11) Here, the question is—If 100 of investment produce 4, what must be invested to produce $3\frac{1}{4}$?

$$4 : 3\tfrac{1}{4} :: 100 : 325\div4=81\tfrac{1}{4}\ \textit{Ans.}$$

(12) $\frac{839\cdot5}{92}$ cents or $\frac{73}{8}$ cents at $£4\frac{1}{2}=£41\ 1s.\ 3d.$ the 1st income.

$\frac{73}{8}$ cents sold out at 94 to buy $3\frac{1}{2}$ per cent. stock at 73 will obtain $\frac{73}{8}\times\frac{94}{73}$ cents$=\frac{47}{4}$ cents, the income from which will be $£3\frac{1}{2}\times\frac{47}{4}=£41\ 2s.\ 6d.$, or an increase of $1s.\ 3d.$ *Ans.*

(13) $5333\frac{1}{3} : 100 :: 3760 : 70\frac{1}{2}$ *Ans.*

(14) $5 : 5\frac{1}{2} :: 100 : 110$ *Ans.*

(15) $\frac{3208\frac{1}{3}}{100}$ cents or $\frac{385}{12}$ cents at $£3\frac{1}{3}=£112\ 5s.\ 10d.$ the 1st income.

$\frac{385}{12}$ cents sold out at 87 to buy 4 per cent. stock at 98 will obtain $\frac{385\times87}{12\times98}$ cents, which at £4$=\frac{£55\times29}{14}$

$=£113\ 18s.\ 6\frac{6}{7}d.=$2nd income

112 5 10

Increase of income £1 12 $8\frac{6}{7}$ *Ans.*

(16) $\frac{2051\cdot25}{100}$ cents at $£3\frac{1}{4}$ $=\frac{£80\cdot0}{66\cdot665625}$, present income,

proposed additional income 13·334375

The question now is—what investment would obtain that additional income, when £95 would obtain $£4\frac{1}{4}$?

$4\frac{1}{4} : 13\cdot3343\frac{3}{4}$,

or 17 : 53·3375 :: £95 : £3·1375×95$=£298\cdot0625$

$=£298\ 1s.\ 3d.$ *Ans.*

(17) $4{\cdot}48 : 3{\cdot}5 :: 100 : 35000 \div 448 = 5000 \div 64 = 78\frac{1}{8}$ *Ans.*
The second inquiry is—What sum will yield £4·48, when £1500 yields £$3\frac{1}{2}$?

$$3{\cdot}5 : 4{\cdot}48 :: £1500 : \frac{£4480 \times 15}{35} = £1920 \text{ Ans.}$$

(18) $\frac{2850}{78\frac{3}{8}}$ cents or $\frac{400}{11}$ cents are to be sold out for £2850 + 50 or £2900; hence, the price of each cent must be $2900 \div \frac{400}{11} = 319 \div 4 = 79\frac{3}{4}$ *Ans.*

(19) *B* pays to *A* $83\frac{1}{8}$ for 100 stock, and receives from *A* 84 for the same 100 stock; therefore, as £1350 is $13\frac{1}{2}$ cents, *B* will gain $(84 - 83\frac{1}{8}) \times 13\frac{1}{2} = \frac{7}{8}$ of £13 10*s.* = £11 16*s.* 3*d.* *Ans.*

(20) The nett income, £210, is $\frac{240-8}{240}$ or $\frac{29}{30}$ of the dividend produced from stock; therefore, £210 ÷ $\frac{29}{30}$ or $\frac{£6300}{29}$ is the amount of dividend, and we are to find the investment that will obtain that income:—

$$3\tfrac{1}{2} : \tfrac{6300}{29} :: £87 : \frac{£3 \times 6300 \times 2}{7} = £5400 \text{ Ans.}$$

(21) $\frac{4186}{100\frac{5}{8}}$ cents or $\frac{208}{5}$ cents at £4 = £166 8*s.* the 1st income; $\frac{208}{5}$ cents sold out at 98 to buy $3\frac{1}{4}$ per cent. stock at 78 will obtain $\frac{208 \times 98}{5 \times 78}$ cents, which at £$3\frac{1}{4}$ = $\frac{£13 \times 52 \times 98}{5 \times 78}$

$$= \frac{£26 \times 98}{15} = £169\ 17s.\ 4d. \text{ the 2nd income;}$$

	166	8	0
Increased by	£3	9	4 *Ans.*

(22) Sold an income of £3 for £90, and therewith bought an income = $\frac{133\frac{1}{3}}{100}$ of £3 = £4. The inquiry now is—If 90 would be the price of 4 per cent. stock, what is the price of $4\frac{1}{2}$ per cent. stock?

$$4 : 4\tfrac{1}{2} :: 90 : 101\tfrac{1}{4} \text{ Ans.}$$

(23) For each £ of investment the income from railway shares would be $\frac{£5\frac{1}{2}}{150}=\frac{£11}{300}$, and that from $3\frac{1}{4}$ per cent. stock, reduced in the ratio of 240*d.* : 233*d.*, would be $\frac{£3\frac{1}{4}}{86}\times\frac{233}{240}$ $=\frac{£3029}{344\times240}$. The former income is to the latter as $\frac{11}{5}:\frac{3029}{1376}$, or as $1376\times11:3029\times5$, or as 15136 : 15145; therefore, the latter is derived from the preferable investment, viz. the $3\frac{1}{4}$ per cents. *Ans.*

(24) $\frac{2941}{85}=\frac{173}{5}$ cents. Now, *A*'s gain $=\frac{2}{3}$ of $\frac{173}{5}$ cents at $£(86\frac{1}{8}-85)$ $+\frac{1}{3}$ of $\frac{173}{5}$ cents at $£(86\frac{3}{4}-85)=\frac{173}{5}\times(\frac{2}{3}$ of $1\frac{1}{8}+\frac{1}{3}$ of $1\frac{3}{4})$ $=£\frac{173}{5}\times\frac{4}{3}=£46\ 2s.\ 8d.$; therefore *B*'s gain, being £18 14*s.* 10*d.* less, $=£27\ 7s.\ 10d.$; so that *B* must have sold out for $£2941+£46\ 2s.\ 8d.+£27\ 7s.\ 10d.=£3014\frac{21}{40}$, and at a price $=3014\frac{21}{40}\div\frac{173}{5}=15072\frac{5}{8}\div173=87\frac{1}{8}$ *Ans.*

AVERAGES.

Ex. 71.

(1) The sum of the six given quantities is 110; which ÷ 6 gives their average $=18\frac{1}{3}$ *Ans.*
Also, $\frac{2}{15}+1\frac{1}{5}=\frac{56}{45}$; which ÷ 2 gives $\frac{28}{45}$ *Ans.*

(2) $3\frac{1}{4}+5\frac{1}{2}+7+8\frac{2}{3}+10\frac{5}{12}=34\frac{5}{6}$; which ÷ 5 $=6\frac{29}{30}$ *Ans.*

(3)

2	at	4	8	= 9	4
2	„	5	3	=10	6
3	„	3	10	=11	6
1	exempt			0	0
11				)45	10
				Ans. 4	2

(4)

35	gals.	at	26*s.*	6*d.*	=	927*s.* 6*d.*
15	„	„	29	0	=	435 0
55	„	„	32	6	=1787	6
105					)3150*s.*	
					Ans. 30*s.*	
					per gal.	

(5)

6 lbs. mixed coffee	at	1*s.*	$4\frac{1}{2}d.$ = 8*s.* 3*d.*
5 lbs. inferior	at	1	4 = 6 8
1 lb. best coffee is worth			1 7 *Ans.*

(6) 39 lbs. sugar sold at $7d.$ amounts to $273d.$

15 lbs. bought at $4\frac{1}{4}d. = 63\frac{3}{4}d.$

24 „ „ $7\frac{1}{2}d. = 180$ $\quad 243\frac{3}{4}$

Gain $29\frac{1}{4}d.$

The gain is $29\frac{1}{4}$ on $243\frac{3}{4}$, or 117 on 975, or 3 on 25;

$\frac{3}{25} \times 100 = 12$ per cent. *Ans.*

Otherwise.

15 lbs. at $4\frac{1}{4}d. = 63\frac{3}{4}d.$

24 „ „ $7\frac{1}{2} = 180$

39 $\quad) 243\frac{3}{4}$

Average cost per lb. $6\frac{1}{4}d.$

$6\frac{1}{4}d. : 7d. :: 100 : 112$,
showing a gain of 12 p. c.
Ans.

(7) $(11{\cdot}1 + 13{\cdot}01 + 12{\cdot}5 + 12) \div 4 = 48{\cdot}61 \div 4 = 12{\cdot}15\frac{1}{4}$, the average;

$11{\cdot}1 \overline{)\ 1{\cdot}05\frac{1}{4}}$

$12{\cdot}15\frac{1}{4} : 100 :: 1{\cdot}05\frac{1}{4} : 42100 \div 4861 = 8{\cdot}66$ p. c. nearly. *Ans.*

(8) Here we are first to find such multipliers for $18d.$ and $15\frac{1}{2}d.$ that the sum of the products may equal the product of $16\frac{1}{4}d.$ by the sum of the multipliers. By the Rule, these multipliers will be as $16\frac{1}{4} - 15\frac{1}{2} : 18 - 16\frac{1}{4}$, or as $\frac{3}{4} : 1\frac{3}{4}$, or as 3 : 7. Now, by the question, the sum of the two multipliers is to be 20; hence, the first will be $\frac{3}{10}$ of $20 = 6$; therefore the quantities required are 6 lbs. and 14 lbs. *Ans.*

(9) Here we are to find such quantities at $£5\frac{1}{4}$ and $£7\frac{7}{20}$ that the average price of both may be £6. These quantities will be as $7\frac{7}{20} - 6 : 6 - 5\frac{1}{4}$, or as $1\frac{7}{20} : \frac{3}{4}$, or as 27 : 15, or as 9 : 5 *Ans.*

(10) $206 \div 25 = 8\frac{6}{25}$, the average multiplier; therefore the two parts will be as $11 - 8\frac{6}{25} : 8\frac{6}{25} - 5$, or as $2\frac{19}{25} : 3\frac{6}{25}$, or as 69 : 81, or as 23 : 27; but the sum of the two parts is to be 25; hence, $\frac{23}{50}$ and $\frac{27}{50}$ of $25 = 11\frac{1}{2}$ and $13\frac{1}{2}$ *Ans.*

(11) $\frac{21}{24}$ is to be an average multiplier for $\frac{18}{24}$ and $\frac{23}{24}$; the two multiplicands, therefore, will be as $23 - 21 : 21 - 18$, or as 2 : 3 but the second is to be $10\frac{1}{2}$ oz.; therefore $3 : 2 :: 10\frac{1}{2}$ oz. : 7 oz. *Ans.*

(12) The two quantities of cloth will be as $5s.\ 9d. - 5s.\ 7d.$: $6s.\ 4d. - 5s.\ 9d.$, or as 2 : 7; but the 2nd is given, 49 yds.; therefore 7 : 2 :: 49 yds. : 14 yds. *Ans.*

(13) $\frac{87}{100}$ is the average multiplier; therefore the two parts will be as $\frac{7}{8} - \frac{87}{100}$: $\frac{87}{100} - \frac{6}{7}$, or as $\frac{1}{200}$: $\frac{9}{700}$, or as 7 : 18; but the sum of both must be 100; therefore the parts are $\frac{7}{25}$ and $\frac{18}{25}$ of 100=28 and 72. *Ans.*

(14) Average price per oz.=168*s.* $9d. \div 36 = 4s.\ 8\frac{1}{4}d.$; therefore the two quantities are as $4s.\ 8\frac{1}{4}d. - 4s.\ 6d.$: $4s.\ 10\frac{1}{2}d. - 4s.\ 8\frac{1}{4}d.$, or as $2\frac{1}{4}$: $2\frac{1}{4}$, the ratio of equality; hence, 18 oz. of each kind were bought. *Ans.*

(15) At the end of the half year, the no. of boys is $\frac{10}{7}$ of what it was originally, and that of girls is $\frac{8}{9}$ of what it was, and the average no. of both is $\frac{19}{15}$ of what it was; therefore the original nos. of boys and girls were as $\frac{19}{15} - \frac{8}{9}$: $\frac{10}{7} - \frac{19}{15}$; or as $\frac{17}{45}$: $\frac{17}{105}$, or as 105 : 45, or as 7 : 3. *Ans.*

(16) Profit on the whole=£874 $10s. - £825 = £49\frac{1}{2}$, which is $\frac{49\frac{1}{2}}{825}$, or $\frac{3}{50}$, or $\frac{6}{100}$ of the prime cost; hence, $\frac{112}{100}$ of the prime cost of the 1st lot added to $\frac{90}{100}$ of that of the 2nd will make $\frac{106}{100}$ of the prime cost of both lots; therefore the two sums of prime cost are as 106 − 90 : 112 − 106, or as 16 : 6, or as 8 : 3.

$$\left.\begin{array}{l} \therefore \frac{8}{11} \text{ of } £825 = £600 \text{ cost of 1st lot} \\ \frac{3}{11} \text{ of } £825 = 225 \quad \text{,,} \quad \text{2nd} \end{array}\right\} \textit{Ans.}$$

(17) 3 a penny is 4*d.* a dozen, and 2 a penny is 6*d.* a dozen; the two quantities, therefore, are as $6d. - 5\frac{1}{2}d.$: $5\frac{1}{2}d. - 4d.$, or as $\frac{1}{2}$: $1\frac{1}{2}$, or as 1 : 3; which shows that the given excess, 5 dozen, is $\frac{3-1}{3+1}$ or $\frac{1}{2}$ of the whole no. of eggs; therefore 10 dozen were bought. *Ans.*

(18) The first two investments, being equal, yield an average of $(5 + 7\frac{1}{2}) \div 2 = 6\frac{1}{4}$ per cent.; therefore $5\frac{1}{8}$ is the average of two quantities, at $6\frac{1}{4}$ and $4\frac{1}{4}$, which two quantities, therefore, are as $5\frac{1}{8} - 4\frac{1}{4}$: $6\frac{1}{4} - 5\frac{1}{8}$, or as $1\frac{1}{12}$: $1\frac{1}{12}$, or as 13 : 11; but the latter of the quantities is given=£3300; hence, 11 : 13+11 :: £3300 : £7200. *Ans.*

(19) The prices per lb. are as 1, $1\frac{1}{2}$, and $1\frac{1}{4}$ of $1\frac{1}{2}$, or as 8, 12, and 15;

1 quantity at 8 = 8 } average price of these
2 at 12 = 24 } = (24+8)÷(2+1) = $10\frac{2}{3}$.

We are to find, therefore, two quantities, at the respective prices $10\frac{2}{3}$ and 15, so that the average price for both may be $1\frac{1}{8}$ of 12 = $14\frac{2}{5}$. The quantities are as $15-14\frac{2}{5} : 14\frac{2}{5}-10\frac{2}{3}$, or as $\frac{3}{5} : 3\frac{11}{15}$, or as 9 : 56; but the latter of the quantities is given = 112 lbs.; therefore,

56 : 9+56 :: 112 lbs. : 130 lbs. *Ans.*

(20) Int. on 100 for 3 mths. = $\frac{1}{4}$ of 5 = $1\frac{1}{4}$; therefore the present worths of 16*s.* 6*d.* and 18*s.* 9*d.* are $\frac{100}{101\frac{1}{4}}$ or $\frac{80}{81}$ of these prices, = $195\frac{5}{9}d.$ and $222\frac{2}{9}d.$

$112\frac{1}{2} : 100 :: 19s.\ 5\frac{1}{3}d. : 207\frac{11}{27}d.$, cash prime cost of the mixture; ∴ the quantities of the two kinds are as $222\frac{2}{9}-207\frac{11}{27}$ is to $207\frac{11}{27}-195\frac{5}{9}$, or as $14\frac{22}{27} : 11\frac{22}{27}$, or as 400 : 320, or as 5 : 4. *Ans.*

(21) Here we are to find two quantities as $1\frac{1}{3}$: 1, or as 4 : 3, so that, being increased respectively by two other quantities as 8 : 13, each amount may be £168.

Accordingly, we have $\frac{4}{7}$ of the sum of the first two quantities added to $\frac{8}{21}$ of the sum of the other two = $\frac{1}{2}$ the amount of both sums; ∴ the sum of the first two quantities is to that of the second two as $\frac{1}{2}-\frac{8}{21} : \frac{4}{7}-\frac{1}{2}$, or as 5 : 3; ∴ £168×2, or £336, being divided into two parts as 5 : 3, gives $\frac{5}{8}$ and $\frac{3}{8}$ of £336 = £210 and £126; and hence, £210 being divided into two parts as 4 : 3 gives £120 and £90, the original salaries. *Ans.*

EQUATION OF PAYMENTS.

Ex. 72.

(1) £60 for 5 mths. = £300 for 1 mth.
36 „ 9 „ = 324 „ „
96) 624
$6\frac{1}{2}$ mths. *Ans.*

(2) £320 for 37 days=£11840 for 1 day
480 „ 27 „ = 12960 „ „
800) 24800
31 da. *Ans.*

(3) £140 for 5 wks.=£700 for 1 wk.
100 „ 11 „ =1100
90 „ 13 „ =1170
330) 2970
9 wks. *Ans.*

(4) £135 for 10 mths.=£1350 for 1 mth.
81 „ 14 „ = 1134
576 „ 17 „ = 9792
792) 12276
$15\frac{1}{2}$ mths. *Ans.*

(5) £143 for 23 days=£3289 for 1 day
99 „ 45 „ = 4455
513 „ 67 „ =34371
81 „ 89 „ = 7209
836) 49324
59 da. *Ans.*

(6) £5700 for 8 months =£45600 for 1 mth.
1400 „ 4 „ =£5600
1000 „ 7 „ = 7000 12600
3300) 33000
10 mths. *Ans.*

(7) 1 sum for 14 months=14 such sums for 1 mth.
$\frac{1}{3}$ for 9 mths.=3
$\frac{1}{5}$ „ 13 „ $=2\frac{3}{5}$ $5\frac{3}{5}$
$\frac{7}{15}$ for $8\frac{3}{5}+\frac{7}{15}$ mths. $= 8\frac{3}{5}$; $\therefore 8\frac{3}{5}+\frac{7}{15}=18$ mths. *Ans.*

(8) (i) The int. on 100 for $1\frac{1}{2}$ yr. is $1\frac{1}{2}$ of $5=7\frac{1}{2}$, and for 2 yrs. is 10. Therefore, to find the true discounts on £86 and £99:—

$107\frac{1}{2}$: $7\frac{1}{2}$ :: £86 : £6, the true disc. on £86,
110 : 10 :: 99 : 9, „ „ „ 99
£15, „ „ „ 185;

and now we have to find the time for which 15 is the true disc. on 185, at 5 p. c. per annum.

185
15

170 : 15 :: 100 : $\frac{150}{17}$ the int. on 100 for the time sought; $\frac{150}{17} \div 5 = \frac{30}{17}$ of a year, =1 yr. $279\frac{3}{17}$ da. the true equated time. *Ans.*

(ii) £86 for $1\frac{1}{2}$ yr. = £129 for 1 yr.
99 „ 2 „ 198
185) 327
By ordinary Rule, 1 yr. $280\frac{6}{37}$ da. *Ans.*

(9) (i) The instalments are as 3, 7, and 6;

True disc. on 3 for 3 mths. = $\frac{1\frac{1}{4}}{101\frac{1}{4}}$ of 3 = $\frac{1}{27}$;

„ „ 7 „ 5 „ = $\frac{2\frac{1}{12}}{102\frac{1}{12}}$ of 7 = $\frac{1}{7}$;

$\frac{1}{27} + \frac{1}{7} = \frac{34}{189}$, the sum of the first two discounts.

Disc. on 16 for 6 mths. = $\frac{2\frac{1}{2}}{102\frac{1}{2}}$ of 16 = $\frac{16}{41}$;

$\frac{16}{41} - \frac{34}{189} = \frac{1630}{7749}$ = disc. on 6 for the time sought;

$6 - \frac{1630}{7749}$: $\frac{1630}{7749}$,

or 44864 : 1630 :: 100 : $\frac{20375}{5608}$, int. on 100 for time sought;

which $\div 5 = \frac{4075}{5608}$ of a yr. = $8\frac{1009}{1402}$ mths., true equated time. *Ans.*

(ii) 16 for 6 months = 96 for 1 mth.
3 „ 3 „ = 9
7 „ 5 „ = 35 44
6 for 52 ÷ 6 mths. = 52; ∴ 52 ÷ 6 = $8\frac{2}{3}$ mths. *Ans.*

EXCHANGE.

Ex. 73.

(1) $1020{\cdot}12\frac{1}{2}\,fr. \div 25{\cdot}32\,fr. = 204025 \div 5064 = £40\ 5s.\ 9\frac{91}{211}d.$ *Ans.*

(2) $25{\cdot}18\,fr. \times 360$

$9064{\cdot}80$

$5s. = \frac{1}{4}$ of £1 $\quad 6{\cdot}29\frac{1}{2}$

$10d. = \frac{1}{6}$ of $5s. \quad 1{\cdot}04\frac{11}{12}$

$9072{\cdot}14\frac{5}{12}\,fr.$

or nearly $9072\,fr.\ 14\frac{1}{2}$ *cts. Ans.*

(3) $2756\,fl. \div 11{\cdot}17\frac{1}{2}\,fl.$
$= 110240 \div 4469$
$= £246\ 13s.\ 6\frac{2262}{4469}d.$ *Ans.*

(4) $4885{\cdot}38\,fl. \div 11{\cdot}20\frac{1}{2}\,fl.$
$= 977076 \div 2241$
$= £436$ *Ans.*

(5) $225\,7\frac{41}{48}$ at $2s. = £225 + 7\frac{41}{48}s. \times 2 = £225\ 15s.\ 8\frac{1}{2}d.$
do. at $\frac{1}{2}d. = 1128\frac{89}{96}d. \quad = \quad 4\ 14\ 0\frac{89}{96}$

$221\ 1\ 7\frac{55}{96}$ *Ans.*

(6) 40 *rupees* for 95 *francs* = 8 *rupees* for 19 *francs*;

$$\frac{1276{\cdot}8}{19} \times 8 = 67{\cdot}2 \times 8 = 537{\cdot}6\ rup.\ Ans.$$

(7) $20)\overline{16{\cdot}75s.}$

$£234{\cdot}8375 = 5946{\cdot}085$ *francs*

$\therefore £1 = 25{\cdot}32$ *francs*, nearly. *Ans.*

(8) $£347{\cdot}775 = 4174{\cdot}17\,fl.$

$\therefore £1 = 12{\cdot}0025\,fl.$ or $12\,fl.\ 0\frac{1}{4}$ *cts.* nearly. *Ans.*

(9) $£417\frac{3}{4} \times 4 = £1671 \times 8 = 182139$ *mks.*

$5691\frac{27}{32}$ *mks.* $\times 32$

$\therefore £8 = 109$ *mks.*; or $£1 = 13$ *mks.* 10 *sch. Ans.*

(10) $£1270\ 17s. \div 8356{\cdot}28 = 7625100d. \div 208907 = 36{\cdot}5d.$ nearly. *Ans.*

(11) Here the inquiry is—If 5 *francs* = $47\frac{1}{2}d.$, how many *francs* = $240d.$?

$47\frac{1}{2}d. : 240d. :: 5\,fr. : \frac{480}{19} = 25{\cdot}26\frac{6}{19}\,fr.$ *Ans.*

(12) £853 15*s.* ÷ 4*s.* 6*d.* = 34150 ÷ 9;

$$\frac{34150}{9} \times \frac{108}{100} = 341{\cdot}5 \times 12 = 4098 \textit{ doll. Ans.}$$

(13) $\frac{4\frac{1}{2}s. \times 5764 \times 100}{110\frac{1}{2}} = \frac{5764s. \times 900}{221} = £1173\ 13s.\ 3\frac{141}{221}d.$ *Ans.*

(14) £435·5 at 25·6 *fr.* per £ = 25·6 *fr.* × 435·5;

$$\frac{25{\cdot}6 \times 435{\cdot}5}{25{\cdot}28} = \frac{£16 \times 4355}{158} = \frac{£4355 \times 8}{79} = £441\ 0s.\ 3d.\ \textit{Ans.}$$

(15) £1, or $13\frac{53}{64}$ *mks.* = $\frac{885}{64}$ *mks.* = $\frac{885}{64 \times 40} \times 35{\cdot}42$ *flor.*

$$= \frac{885}{64 \times 40} \times \frac{35{\cdot}42}{57\frac{1}{2}} \times 120 \textit{ fr.}, \text{ or } \frac{177 \times 3542 \times 120}{64 \times 8 \times 5750} \textit{ fr.}$$

$$= \frac{177 \times 77 \times 3}{4 \times 8 \times 50} \textit{ fr.} = \frac{408{\cdot}87}{16} \textit{ fr.} = 25{\cdot}55\frac{7}{16} \textit{ fr. Ans.}$$

Otherwise.—By the *Chain Rule.*

? *francs* = £1 when £1 = $13\frac{53}{64}$ *mks.* 40 *mks.* = 35·42 *fl.* 57·5 *fl.* = 120 *francs*	The working out of this statement, viz. the division of the continued product of the right hand nos. by that of the left hand nos., is the same as before.

(16) The direct course gives 1 *mk.* = £$\frac{1}{13\frac{5}{8}}$ = £$\frac{8}{109}$.

By the circuitous remittance we have 1 *mk.* = $\frac{275}{150}$ *francs*

$$= \frac{275 \times 136}{150 \times 300} \textit{ flor.} = £\frac{275 \times 136 \times 100}{150 \times 300 \times 1078} = £\frac{34}{441}.$$

£$\frac{34}{441}$ − £$\frac{8}{109}$ = £$\frac{3706 - 3528}{441 \times 109}$ = the advantage, per *mark*, by indirect remittance; hence, £$\frac{178}{48069}$ × 2852½ = £10 11*s.* 3·081*d.* nearly, the amount of difference in favour of the indirect course. *Ans.*

Instead of the above method of finding how much sterling the *mark* would produce by indirect remittance, the *Chain Rule* might be used in the annexed form:—

? £ = 1 *mk.*
150 *mks.* = 275 *fr.*
300 *fr.* = 136 *fl.*
1078 *fl.* = £100.

(17) By the direct course, St. Petersburg has to pay $\frac{1}{30\frac{1}{4}}$ or $\frac{4}{121}$ of a *ruble* for every 1*d.* in the sum owing; but, by the indirect course, for every 1*d.* there will be $\frac{11\frac{5}{6}}{240}$ *fl.* $=\frac{11\frac{5}{6}\times 20}{240\times 9\frac{5}{12}}$ *fr.* $=\frac{11\frac{5}{6}\times 20}{240\times 9\frac{5}{12}\times 3}$ *ru.* $=\frac{71}{113\times 18}$ *ru.*, which, increased by the expense of remittance, will amount to $\frac{71}{2034}\times\frac{101\frac{1}{2}}{100}$ $=\frac{14413}{406800}$ *ru.*

$\frac{14413}{406800}-\frac{4}{121}=\frac{116773}{406800\times 121}$ *ru.*, the advantage, per penny, by direct remittance; and this $\times$ 176856, the no. of pence in £736 18*s.*, gives $\frac{7369\times 116773}{16950\times 121}=419{\cdot}562$ *ru.* nearly, the amount of difference in favour of the direct course. *Ans.*

For the calculation of the indirect course in the above solution, the method of the *Chain Rule* might be substituted, as follows:—

	Or,
? *rubles*=1*d.*	? *rubles*=1*d.*
240*d.*=$11\frac{5}{6}$ *kr.*	240*d.* $\times$ 6=71 *kr.*
$9\frac{5}{12}$ *kr.*=20 *fr.*	113 *kr.*=240 *fr.*
3 *fr.*=1 *ru.*	3 *fr.*=1 *ru.*
100 *ru.*=$101\frac{1}{2}$ *ru.*	200 *ru.*=203 *ru.*

(18) 50 kilogr.=$110\frac{1}{4}$ lbs.; the cost of which in London, with export charges, is $\frac{3\frac{5}{8}d.\times 110\frac{1}{4}\times 110}{100}=\frac{27d.\times 441\times 11}{320}$.

Selling price at Marseilles$=\frac{25{\cdot}6\,fr.\times 27\times 441\times 11\times 100}{240\times 320\times 94\frac{1}{2}}$

$=\frac{256\,fr.\times 27\times 441\times 11}{24\times 32\times 945}=\frac{21\times 11}{5}=46\frac{1}{5}$ *francs. Ans.*

(19) $\left.\begin{matrix}25{\cdot}20 : 25{\cdot}17\\ 1000 : 1004\end{matrix}\right\}$ :: 100 : 100·28 nearly;

therefore gold is about 28, or nearly 3 *tenths* per cent., dearer in Paris than in London. *Ans.*

(20) $\left.\begin{matrix}100 : 100{\cdot}2 \\ 1000 : 1003\frac{1}{2}\end{matrix}\right\}$ :: 25·17 *fr.* : 25·31 *fr.* per £ nearly. *Ans.*

(21) 25·17 : 25·225 :: 1000 : 1002 nearly;
or, about 2 per mille premium. *Ans.*

(22) 13 *mks.* $6\frac{1}{4}$ *sch.* $=13\frac{25}{64}$ *mks.*;
$\frac{13\frac{25}{64}\times 100}{425\times{\cdot}03132}=\frac{857}{272\times{\cdot}03132}=100{\cdot}6$ nearly;
or, about 6 *tenths* per cent. dearer in London. *Ans.*

(23) 426·5 *mks.* × ·03132 = 13·358 *mks.* = 13 *mks.* $5\frac{3}{4}$ *sch.* nearly; that is, about the same price as in London. *Ans.*

(24) 100·4 : 100 :: $13\frac{5}{16}$ ÷ ·03132 : 423·35 nearly. *Ans.*

RECTANGULAR AREAS.

Ex. 74.

(1) 63 sq. ft. × $6\frac{1}{4}=393\frac{3}{4}$ sq. ft., or 393 sq. ft. 108 in. *Ans.*

(2) 117 sq. in. × 31 = 3627 sq. in. = 25 sq. ft. 27 in. *Ans.*

(3) $137\frac{1}{2}$ sq. yds. × $\frac{131}{3}=6004\frac{1}{6}$ sq. yds. *Ans.*

(4) $2\frac{1}{2}$ ft. ÷ 3 ft. $=\frac{5}{6}$ yd.; and $11\frac{1}{4}$ in. ÷ 36 in. $=\frac{5}{16}$ yd.;
hence, $\frac{5}{6}$ sq. yd. × $\frac{5}{16}=\frac{25}{96}$ sq. yd. *Ans.*

(5) 2950 sq. links × 1835 ÷ 100000 sq. links = 54·1325 acres,
= 54 ac. $21\frac{1}{5}$ po. *Ans.*

(6)
40) 22·00 po.
4) 1·55 ro.
2·3875 ac.

2·3875
100000 sq. lks.
250) 238750 sq. lks.
Length, 955 links. *Ans.*

(7) 71 sq. in. × 71 = 5041 sq. in. = 35 sq. ft. 1 in. *Ans.*

(8) 14 ft. 10 in. = 178 in.; and 12 sq. yds. 5 ft. 104 in. = 16376 sq. in.;
16376 sq. in. ÷ 178 sq. in. = 92; and 92 in. = 7 ft. 8 in. *Ans.*

(9) $36\frac{1}{2}$ ft.$=12\frac{1}{6}$ yds.; and $31\frac{1}{3}$ ft.$=10\frac{4}{9}$ yds.;
$12\frac{1}{6}$ sq. yds.$\times 10\frac{4}{9}$, at 3*s.* 6*d.*, $=42d.\times\frac{73}{6}\times\frac{94}{9}=$£22 4*s.* $9\frac{1}{3}d.$
Ans.

(10) Dimensions of floor, 30 ft. and 21 ft.; dimensions of each plank, $11\frac{2}{3}$ ft. and $\frac{3}{4}$ ft.; $(30$ sq. ft.$\times 21)\div(11\frac{2}{3}$ sq. ft.$\times\frac{3}{4})$
$=(30\times 21\times 4)\div 35=6\times 3\times 4=72$ planks. *Ans.*

(11) $67\frac{1}{2}$ sq. in.$\times 38\frac{1}{2}=\frac{67\frac{1}{2}\times 38\frac{1}{2}}{144\times 9}$ sq. yds.; which, at 55*d.* a yard,
would amount to $\frac{55d.\times 135\times 77}{144\times 9\times 4}=\frac{55d.\times 5\times 77}{192}=9s.\ 2\frac{55}{192}d.$
Ans.

(12) 250 sq. in.$\times 185\frac{1}{7}=\frac{250\times 185\frac{1}{7}}{144\times 9}$ sq. yds.$=\frac{250\times 1296}{144\times 9\times 7}=250\div 7$
$=35\frac{5}{7}$ sq. yds. *Ans.*

(13) $2\frac{1}{6}$ sq. ft.$\times$ the no. of feet in length of carpet must be$=20\frac{7}{12}$ sq. ft.
$\times 20\frac{1}{4}$; $\therefore$ the length of carpet in yards$=(20\frac{7}{12}\times 20\frac{1}{4})\div(2\frac{1}{6}\times 3)$
$=(247\times 81)\div(26\times 12)=(19\times 27)\div 8=64\frac{1}{8}$ yds. *Ans.*

(14) Sq. yds. of carpet required$=(14\frac{1}{6}\times 13\frac{1}{2})\div 9=21\frac{3}{10}$; and as
the carpet is yard wide, it must be $21\frac{3}{10}$ yds. long. *Ans.*

(15) The dimensions, in yards, are$=10{\cdot}02\div 3$ and $9{\cdot}342\div 36$;
$\frac{10{\cdot}02\text{ sq. yds.}\times 9{\cdot}342}{3\times 36}=5{\cdot}01\times{\cdot}173={\cdot}86673$ sq. yd. *Ans*

(16) $2{\cdot}75\frac{1}{3}$ sq. ft.$\times$ the no. of feet in length of carpet must be
$=29\frac{1}{2}$ sq. ft.$\times 29\frac{1}{2}$; $\therefore$ the length of carpet in yards$=(29\frac{1}{2}\times 29\frac{1}{2})$
$\div(2{\cdot}75\frac{1}{3}\times 3)=(295\times 295)\div 826=295\times 5\div 14=105\frac{5}{14}$ yds.
Ans.

(17) No. of ft. in circuit of walls$=(23\frac{1}{2}+17)\times 2=81$ ft.; area to
be covered$=\frac{4}{5}$ of 81 sq. ft.$\times 12\frac{1}{2}$; or $\frac{4}{5}$ of 9 sq. yds.$\times 12\frac{1}{2}$
$=90$ sq. yds. *Ans.*

(18) No. of feet in circuit of walls$=(17+15)\times 2=64$ ft.; no.
of sq. yds. of paper required$=(64$ sq. ft.$\times 13)\div 9$ sq. ft.,
$=92\frac{4}{9}$ sq. yds., $=\frac{1}{3}$ sq. yd.$\times$ the no. of yds. in length of paper;
$\therefore$ length of paper$=92\frac{4}{9}\times 2=184\frac{8}{9}$ lineal yds. *Ans.*

(19) No. of ft. in circuit of walls $=(21 \text{ ft. } 4 \text{ in.} + 17 \text{ ft. } 5 \text{ in.}) \times 2 = 77\frac{1}{2}$; no. of sq. yds. of paper required $=(77\frac{1}{2} \text{ sq. ft.} \times 13\frac{1}{4}) \div 9 \text{ sq. ft.}$, $= \frac{8215}{72} \text{ sq. yds.}$, $= \frac{16\frac{1}{2}}{36}$ sq. yd. × the no. of yds. in length of paper; ∴ length of paper $= \frac{8215}{72} \div \frac{33}{72} = \frac{8215}{33}$ $= 248\frac{31}{33}$ yds. *Ans.*

(20) No. of sq. yds. of carpet $= (23\frac{1}{3} \text{ sq. ft.} \times 18\frac{3}{4}) \div 9 \text{ sq. ft.}$ $= \frac{875}{18} \text{ sq. yds.}$, $= \frac{3}{4}$ sq. yd. × the no. of lineal yards of carpet; ∴ length of carpet required $= \frac{875}{18} \div \frac{3}{4}$, which, at 6*s.* 6*d.* a yard, will cost $\frac{13}{2}s. \times \frac{875}{18} \times \frac{4}{3} = \frac{11375s.}{27} = £21\ 1s.\ 3\frac{5}{9}d.$ *Ans.*

(21) Circuit of walls $=(31 \text{ ft. } 2 \text{ in.} + 17 \text{ ft. } 10 \text{ in.}) \times 2 = 98 \text{ ft.}$; no. of sq. yds. of paper required $=(98 \text{ sq. ft.} \times 13\frac{1}{2}) \div 9 \text{ sq. ft.}$ $= 147 \text{ sq. yds.}$, $= \frac{7}{8}$ sq. yd. × the no. of lineal yds. of paper; ∴ length of paper $= 147 \div \frac{7}{8} = 168$ lineal yds., which, at 8*d.* a yd., amounts to £5 12*s.* *Ans.*

(22) Circuit of walls $=(29 \text{ ft. } 7 \text{ in.} + 21 \text{ ft. } 4 \text{ in.}) \times 2 = 101\frac{5}{6} \text{ ft.}$; no. of sq. yds. of paper required $= \frac{5}{6}$ of $(101\frac{5}{6} \text{ sq. ft.} \times 12\frac{11}{12}) \div 9 \text{ sq. ft.}$, $= \frac{5}{6}$ of $\frac{611}{6} \times \frac{155}{12} \times \frac{1}{9}$ sq. yds., $= \frac{11\frac{3}{4}}{36}$ sq. yd. × the no. of lineal yds. of paper; ∴ the length of paper valued at $7\frac{1}{2}d.$ a yd. will amount to $\frac{15d.}{2} \times \frac{5}{6} \times \frac{611}{6} \times \frac{155}{12} \times \frac{1}{9} \times \frac{36 \times 4}{47} = \frac{25d. \times 13 \times 155}{18}$ $= £11\ 13s.\ 2\frac{11}{18}d.$ *Ans.*

(23) Circuit of walls $=(27 \text{ ft. } 8\frac{1}{2} \text{ in.} + 17 \text{ ft. } 3\frac{1}{2} \text{ in.}) \times 2 = 90 \text{ ft.}$; no. of sq. yds. of paper required $=(90 \text{ sq. ft.} \times 13\frac{1}{3}) \div 9 \text{ sq. ft.}$, $= 133\frac{1}{3} \text{ sq. yds.} = \frac{20}{36}$ sq. yd. × the no. of lineal yds. of paper; ∴ the length of paper is $= \frac{400}{3} \div \frac{20}{36} = 240$ lineal yds., amounting to £6 10*s.*, which is at the rate of $130s. \div 240 = 130d. \div 20$ $= 6\frac{1}{2}d.$ a yard. *Ans.*

(24) Length of paper required $= 132s.\ 3\frac{3}{4}d. \div 7\frac{1}{4}d. = 219 \text{ yds.} = 657 \text{ ft.}$; circuit of room $= 18\frac{1}{4} \text{ ft.} \times 4 = 73 \text{ ft.}$; no. of sq. ft. of paper required $= 73 \text{ sq. ft.} \times$ no. of ft. in the height $= 657 \text{ sq. ft.} \times \frac{17}{12}$; ∴ the height of the room in feet $= \frac{657}{73} \times \frac{17}{12} = \frac{51}{4} = 12 \text{ ft. } 9 \text{ in.}$ *Ans.*

RECTANGULAR VOLUMES.

Ex. 75.

(1) (38×30) cub. in. $\times 27=\frac{38\times30}{1728}$ cub. ft. $\times 27=\frac{38\times30}{64}$ cub. ft.
$=17\frac{13}{16}$ cub. ft. *Ans.*

(2) (185×28) cub. in. $\times 25=129500$ cub. in. $=74$ c. ft. 1628 in.
Ans.

(3) $(88\frac{1}{2}\times38)$ cub. in. $\times 2\frac{1}{4}=\frac{88\frac{1}{2}\times38\times2\frac{1}{4}}{1728}$ c. ft., at 168 lbs. per ft.
$=\frac{21 \text{ lbs.}\times177\times38\times9}{1728}=\frac{7 \text{ cwt.}\times177\times19}{32\times112}=\frac{3363}{512}$ cwt.
$=6$ cwt. 2 qrs. 7 lbs. $10\frac{1}{2}$ oz. *Ans.*

(4) $\frac{(51{\cdot}7\times48{\cdot}9) \text{ cub. in.}\times26{\cdot}267}{277{\cdot}274 \text{ cub. in.}}=\frac{66406391}{277274}$ gall.
$=239\frac{1}{2}$ gals. nearly. *Ans.*

(5) (19×14) cub. in. $\times$ the no. of inches thickness $=1728$ cub. in.;
$\therefore$ the thickness $=1728\div(19\times14)=864\div133=6\frac{1}{2}$ in. nearly.
Ans.

(6) $\frac{(238\times238) \text{ cub. in.}\times238}{(8\times4\frac{1}{4}) \text{ cub. in.}\times3\frac{1}{2}}=238\times238\times2=113288$ st. *Ans.*

(7) 61 ft. $\div 2=30\frac{1}{2}$ ft., the sum of length and breadth; $\therefore \frac{1}{2}(30\frac{1}{2}+3)$
$=16\frac{3}{4}$ ft. long; $\therefore$ $13\frac{3}{4}$ ft. broad; length of paper required
$=127s.\ 1d.\div5d.=305$ yds. $=915$ ft.; and the width of paper is $\frac{3}{4}$ ft.; $\therefore$ the area of the walls $=915$ sq. ft. $\times\frac{3}{4}$, and also $=61$ sq. ft. $\times$ the no. of feet in the height of the room; hence, the height of the room is $=\frac{915\times\frac{3}{4}}{61}$ ft. $=11\frac{1}{4}$ ft.; and the volume of air contained in the room $=(\frac{67}{4}\times\frac{55}{4})$ c. ft. $\times\frac{45}{4}=165825$ c. ft. $\div64=2591$ c. ft. 27 in. $=95$ c. yds. 26 ft. 27 in. *Ans.*

DUODECIMALS.

Ex. 76.

(1)

sq. ft.	′	
8	7	
7	3	
60	1	
2	1	9
Ans. 62	2′	9″
	12	

or, 62 sq. ft. 33 sq. in.

sq. ft.	′	
11	5	
6	8	
68	6	
7	7	4
Ans. 76	1′	4″
	12	

or, 76 sq. ft. 16 sq. in.

(2)

sq. ft.	′	″	
8	5	10	
7	11		
59	4	10	
7	9	$4\frac{1}{6}$	
Ans. 67	2′	$2\frac{1}{6}$″	
	12		

or, 67 sq. ft. $26\frac{1}{6}$ sq. in.

sq. ft.	′	″	‴	
13	3	7	6	
13	3	7	6	
172	11	1	6	
3	3	10	10	6
	7	9	1	$4\frac{1}{2}$
		6	7	$9\frac{3}{4}$
Ans. 176	11′	4″	1‴	$8\frac{1}{4}$⁗
	12		12	
			$20\frac{1}{4}$	

176 sq. ft. 136 sq. in. $+\frac{20\frac{1}{4}}{144}$ sq. in.

or, 176 sq. ft. $136\frac{9}{64}$ sq. in.

(3)

sq. ft.	′	″		
13	1	7		
12	8	5		
157	7	0		
8	9	0	8	
	5	5	$7\frac{11}{12}$	
Ans. 166	9′	6″	$3\frac{11}{12}$‴	
	12		12	

or, 166 sq. ft. $114\frac{47}{144}$ sq. in.

sq. ft.	′	″	
6	0	9	
0	6	9	
3	0	4	6
	4	6	$6\frac{3}{4}$
Ans. 3	4′	11″	$0\frac{3}{4}$‴
	12		

or, 3 sq. ft. $59\frac{1}{16}$ sq. in.

(4)

sq. ft.	′	″	
0	3	8	
0	10	3	
0	3	0	8
0	0	0	11
Ans. 0	3′	1″	7‴
	12		

or, $37\frac{7}{12}$ sq. in.

sq. ft.	′	″	
2	11	11	
2	3		
5	11	10	
	8	11	9
Ans. 6	8′	9″	9‴
	12		

or, 6 sq. ft. $105\frac{3}{4}$ sq. in.

(5)

sq. ft.	′	″	
16	7	0	
0	7	5	
9	8	1	
	6	10	11
Ans. 10	2′	11″	11‴
	12		

or, 10 sq. ft. $35\frac{11}{12}$ sq. in.

sq. ft.	′	″	
13	11	0	
6	11	4	
83	6	0	
12	9	1	
	4	7	8
Ans. 96	7′	8″	8‴
	12		

or, 96 sq. ft. $92\frac{2}{3}$ sq. in.

(6)

sq. ft.	′	
4	9	
3	6	
14	3	
2	4	6
16	7′	6″

cub. ft.	′	″	
16	7	6	
2	3		
33	3	0	
4	1	10	6
Ans. 37	4′	10″	6‴
	12		

$58\times12+6$

or, 37 cub. ft. 702 c. in.

(7)

sq. ft.	′	″
15	4	6
5	8	
76	10	6
10	3	0
87	1′	6″

cub. ft.	′	″
87	1	6
$3\frac{1}{4}$		
261	4	6
21	9	$4\frac{1}{2}$
Ans. 283	1′	$10\frac{1}{2}$″
	12	

$22\frac{1}{2}\times12$

or, 283 cub. ft. 270 c. in.

(8)

sq. ft.	′	″
21	0	2
4	7	
84	0	8
12	3	1 2
96	3′	9″ 2‴

cub. ft.	′	″	‴
96	3	9	2
0	11		

Ans. 88 · 3′ 5″ $4\frac{5}{6}$‴

$41 \times 12 + 4\frac{5}{6}$

or, 88 cub. ft. $496\frac{5}{6}$ c. in.

(9) 2 sq. ft. 5′ 6″ : 5 sq. ft. 8′ $5\frac{1}{12}$″ :: 1 ft. length

12 — 12

29 — 68

12 — 12

354 —) $821\frac{1}{12}$

2 ft. 3′ 10″ *Ans.*

(10) 25 sq. ft. 4′) 250 sq. ft. 8′ 4″

12 — 12

304 — $3008\frac{1}{3}$

3 — 3

912 —) 9025

9 units $10\frac{3}{4}$ twelfths. *Ans.*

(11) 47 sq. ft. 9′ 11″ : 41 sq. ft. 10′ $2\frac{1}{8}$″ :: 1 ft. length

12 — 12

573 — 502

12 — 12

6887 —) $6026\frac{1}{8}$

0 ft. 10′ 6″ *Ans.*

(12) 24 c. ft. 5′ 4″ 11‴ : 61 c. ft. 1′ 6″ $3\frac{1}{2}$‴ :: 1 ft. thick

12 — 12

293 — 733

12 — 12

3520 — 8802

12 — 12

42251 —) $105627\frac{1}{2}$

2 ft. 6′ *Ans.*

SQUARE ROOT.

Ex. 77.

$\sqrt{77841}=279$ *Ans.*

4

47 | 378
329

549 | 4941
4941

(1) $\sqrt{1369}=37$ *Ans.*

9

67 | 469
469

$\sqrt{6241}=79$ *Ans.*

49

149 | 1341
1341

(2) $\sqrt{434281}=659$ *Ans.*

36

125 | 742
625

1309 | 11781
11781

$\sqrt{739600}=860$ *Ans.*

64

166 | 996
996

$\sqrt{1428025}=1195$ *Ans.*

121

229 | 2180
2061

2385 | 11925
11925

(3) $\sqrt{817216}=904$ *Ans.*

81

1804 | 7216
7216

(4) $\sqrt{34819056}=1866$ *Ans.*

1

28 | 248
224

366 | 2419
2196

3726 | 22356
22356

$\sqrt{53222496}=2307$ *Ans.*

4

43 | 132
129

4607 | 32249
32249

(5) $\sqrt{24502500}=4950$ *Ans.*

16

89 | 850
801

985 | 4925
4925

$\sqrt{3620\cdot4289}=60\cdot17$ *Ans.*

36

1201 | 2042
1201

12027 | 84189
84189

(6) $\sqrt{9798\cdot822121}=98\cdot989$ *Ans.*

81	
188 | 1698	
1504	
1969 | 19482	
17721	
19788 | 176121	
158304	
197969 | 1781721	
1781721	

$\sqrt{1\cdot048576}=1\cdot024$ *Ans.*

100	
202 | 485	
404	
2044 | 8176	
8176	

(7) $\sqrt{3481826049}=59007$ *Ans.*

25	
109 | 981	
981	
118007 | 826049	
826049	

$\sqrt{\cdot96177249}=\cdot9807$ *Ans.*

81	
188 | 1517	
1504	
19607 | 137249	
137249	

(8) $\sqrt{\cdot10227204}=\cdot3198$ *Ans.*

9	
61 | 122	
61	
629 | 6172	
5661	
6388 | 51104	
51104	

$\sqrt{8260\cdot9921}=90\cdot89$ *Ans.*

81	
1808 | 16099	
14464	
18169 | 163521	
163521	

$\sqrt{\cdot000977\dot{1}876}=\cdot03126$ *Ans.*

9	
61 | 77	
61	
622 | 1618	
1244	
6246 | 37476	
37476	

(9) $\sqrt{\cdot00717409}=\cdot0847$ *Ans.*

64	
164 | 774	
656	
1687 | 11809	
11809	

(10) $\sqrt{609804810000} = 780900$ *Ans.*

49
148 | 1198
| 1184
15609 | 140481
| 140481

$\sqrt{\cdot 009801} = \cdot 099$ *Ans.*

81
189 | 1701
| 1701

$\sqrt{1\cdot 5240} = 1\cdot 2345$ nearly. *Ans.*

144
243 | 840
| 729
2464 | 11100
| 9856
24685 | 124400
| 123425
9750

(11) $\sqrt{24\cdot 6810} = 4\cdot 968$ nearly.

16 *Ans.*
89 | 868
| 801
986 | 6710
| 5916
992 | 79400

(12) $\sqrt{127021\cdot 55} = 356\cdot 4008$, &c.

9 *Ans.*
65 | 370
| 325
706 | 4521
| 4236
7124 | 28555
| 28496
7128008 | 59000000
| 57024064
1975936

$\sqrt{\cdot 301030} = \cdot 548662$, &c.

25 *Ans.*
104 | 510
| 416
1088 | 9430
| 8704
10966 | 72600
| 65796
109726 | 680400
| 658356
22044

(13) $\sqrt{39484} = 198\cdot 706$ nearly.

1 *Ans.*
29 | 294
| 261
388 | 3384
| 3104
3967 | 28000
| 27769
39740 | 2310000

$\sqrt{\cdot 01030390} = \cdot 101508$, &c.

1 *Ans.*
201 | 0303
| 201
2025 | 10290
| 10125
203008 | 1650000
| 1624064
25936

(14) $\sqrt{6}=2{\cdot}4495$ nearly. *Ans.*

	4	
44	200	
	176	
484	2400	
	1936	
4889	46400	
	44001	
4898	239900	

$\sqrt{\cdot60}=\cdot7746$ nearly. *Ans.*

	49	
147	1100	
	1029	
1544	7100	
	6176	
1548	92400	

$\sqrt{\cdot02}=\cdot14142$, &c. *Ans.*

	1	
24	100	
	96	
281	400	
	281	
2824	11900	
	11296	
2828	60400	

$\sqrt{26}=5{\cdot}09902$ nearly.

	25	*Ans.*
1009	10000	
	9081	
10189	91900	
	91701	
101980	1990000	

(15) $\sqrt{\frac{2}{5}}=\sqrt{\cdot40}=\cdot63245$, &c. *Ans.* $\sqrt{\frac{4}{9}}=\sqrt{\frac{2\times2}{3\times3}}=\frac{2}{3}$ *Ans.*

$\sqrt{\frac{1}{3}}=\sqrt{\cdot3\dot{3}\dot{3}\dot{3}}$, &c.$=\cdot57735$, &c. *Ans.*

$\sqrt{1\frac{5}{6}}=\sqrt{1{\cdot}8\dot{3}\dot{3}\dot{3}}$, &c.$=1{\cdot}354$, &c. *Ans.*

(16) $\sqrt{2{\cdot}08\dot{3}\dot{3}\dot{3}\dot{3}}$, &c.$=1{\cdot}44337$, &c. *Ans.*

$\sqrt{5\frac{4}{9}}=\frac{\sqrt{49}}{\sqrt{9}}=\frac{7}{3}=2\frac{1}{3}$ *Ans.* $\sqrt{55{\cdot}1250}=7{\cdot}42462$, &c. *Ans.*

$\sqrt{30\frac{1}{4}}=\frac{\sqrt{121}}{\sqrt{4}}=\frac{11}{2}=5\frac{1}{2}$ *Ans.*

(17) $\sqrt{1\dot{5}9\dot{2}{\cdot}3\dot{3}\dot{3}\dot{3}}$, &c.$=39{\cdot}90405$, &c. *Ans.*

$\sqrt{558{\cdot}53\frac{4}{9}}=\sqrt{5026{\cdot}81}\div\sqrt{9}=70{\cdot}9\div3=23{\cdot}6\dot{3}$ *Ans.*

$\sqrt{\frac{54}{99}}=\sqrt{\frac{6}{11}}=\frac{\sqrt{66}}{\sqrt{121}}=\frac{1}{11}\sqrt{66}=\frac{1}{11}$of $8{\cdot}124038=\cdot738549$ nearly. *Ans.*

(18) $\sqrt{13{\cdot}7\frac{2}{7}}=\sqrt{96{\cdot}1}\div\sqrt{7}=\sqrt{672{\cdot}7}\div\sqrt{49}=25{\cdot}9364$, &c.$\div7$ $=3{\cdot}7052$, &c. *Ans.*

$\sqrt{\cdot0700\frac{5}{9}}=\sqrt{\cdot6305}\div\sqrt{9}=\cdot79404$, &c.$\div3=\cdot26468$, &c. *Ans.*

$\sqrt{\cdot310310310}$, &c.$=\cdot557055$, &c. *Ans.*

Ex. 78.

(1) $\sqrt{(49\times81)}=\sqrt{49}\times\sqrt{81}=7\times9=63$ *Ans.*
$\sqrt{(64\times30\frac{1}{4})}=\sqrt{64}\times\sqrt{30\frac{1}{4}}=8\times5\frac{1}{2}=44$ *Ans.*

(2) $\sqrt{(81\times8\times2)}=\sqrt{81}\times\sqrt{16}=9\times4=36$ *Ans.*
$\sqrt{(18\times12\times6)}=\sqrt{(36\times6\times6)}=\sqrt{36}\times\sqrt{36}=36$ *Ans.*

(3) $\sqrt{(42\times24\times28)}=\sqrt{(7\times144\times7\times4)}=7\times12\times2=168$ *Ans.*
$\sqrt{(12\frac{1}{2}\times18)}=\sqrt{(25\times9)}=5\times3=15$ *Ans.*

(4) $\sqrt{(56\times40\times35)}=\sqrt{(7\times8\times40\times5\times7)}=7\times40=280$ *Ans.*
$\sqrt{(33\times8\frac{1}{4})}=\sqrt{33}\times\frac{1}{2}\sqrt{33}=\frac{1}{2}$ of $33=16\frac{1}{2}$ *Ans.*

(5) $\sqrt{65}\times\sqrt{45}\times\sqrt{52}=\sqrt{13}\times\sqrt{5}\times\sqrt{5}\times\sqrt{9}\times\sqrt{4}\times\sqrt{13}$
$=13\times5\times3\times2=390$ *Ans.*
$\sqrt{13\frac{1}{2}}\times\sqrt{1\frac{1}{2}}=\sqrt{(\frac{1}{4}\text{ of }27\times3)}=\frac{1}{2}\sqrt{81}=4\frac{1}{2}$ *Ans.*

(6) $\sqrt{\frac{5}{2}}\times\sqrt{\frac{5}{3}}\times\sqrt{\frac{3}{2}}=\sqrt{\frac{25}{4}}=\frac{5}{2}=2\frac{1}{2}$ *Ans.*
$\sqrt{\frac{175}{2}}\times\sqrt{\frac{7}{8}}=\frac{\sqrt{25}\times\sqrt{7}\times\sqrt{7}}{\sqrt{16}}=\frac{35}{4}=8\frac{3}{4}$ *Ans.*

(7) $\sqrt{(15\times27)}=\sqrt{(5\times81)}=9\sqrt{5}$ *Ans.*
$\sqrt{(32\times30\frac{1}{4}\times22)}=\sqrt{(8\times121\times22)}=\sqrt{(16\times121\times11)}$
$=44\sqrt{11}$ *Ans.*

(8) $\frac{3}{14}$ of $2\sqrt{5}\times\frac{3}{8}$ of $\frac{1}{2}\sqrt{10}=\frac{3}{14}\times\frac{3}{8}\times\frac{1}{2}\times2\sqrt{50}=\frac{1}{7}\sqrt{(25\times2)}$
$=\frac{5}{7}\sqrt{2}$ *Ans.*

(9) $\sqrt{\frac{1}{13}\text{ of }\left(\frac{49}{156}-\frac{23}{144}\right)}=\sqrt{\frac{1}{13}\text{ of }\frac{588-299}{1872}}$
$=\sqrt{\frac{289}{13\times13\times144}}=\frac{17}{13\times12}=\frac{17}{156}$ *Ans.*

(10) $\sqrt{\left(\frac{3}{95}+\frac{5}{57}+\frac{15}{76}\right)}\times\sqrt{\frac{19}{60}}=\sqrt{\left(\frac{3}{5}+\frac{5}{3}+\frac{15}{4}\right)\times\frac{1}{60}}$
$\sqrt{\frac{36+100+225}{60\times60}}=\frac{\sqrt{361}}{60}=\frac{19}{60}$ *Ans.*

(11) $\frac{3}{\sqrt{5}}=\frac{3\times\sqrt{5}}{\sqrt{5}\times\sqrt{5}}=\frac{3\sqrt{5}}{5}$, or $\frac{3}{5}\sqrt{5}$ *Ans.*

$\frac{8}{3\sqrt{6}}=\frac{8\times\sqrt{6}}{3\times6}=\frac{4}{9}\sqrt{6}$ *Ans.*

$\frac{\sqrt{8}}{5\sqrt{2}}=\frac{1}{5}$ of $\sqrt{\frac{8}{2}}=\frac{1}{5}\sqrt{4}=\frac{2}{5}$ *Ans.*

(12) $\frac{\frac{1}{3}\sqrt{15}}{\frac{1}{2}\sqrt{3}}=\frac{2}{3}\sqrt{\frac{15}{3}}=\frac{2}{3}\sqrt{5}$ *Ans.*

$\frac{\sqrt{4\frac{1}{2}}}{6\sqrt{90}}=\frac{1}{6}\sqrt{\frac{1}{20}}=\frac{1}{6}\sqrt{\frac{5}{100}}=\frac{\sqrt{5}}{6\times10}$, or $\frac{1}{60}\sqrt{5}$ *Ans.*

$$\frac{5\sqrt{6}}{\sqrt{8}+2\sqrt{3}}=\frac{5\sqrt{2}\times\sqrt{3}}{1}+\frac{2\sqrt{2}}{2\sqrt{3}}=\frac{5\sqrt{2}\times\sqrt{3}}{1}\times\frac{\sqrt{3}}{\sqrt{2}}$$
$$=5\sqrt{3}\times\sqrt{3}=5\times3=15 \text{ } Ans.$$

Ex. 79.

(1) $\sqrt{26\frac{25}{36}}$ sq. ft.$=\sqrt{\frac{961}{36}}=\frac{31}{6}=5\frac{1}{6}$ ft. *Ans.*

(2) 40 | 13·16 po.
4 | 1·329 ro.

1·33225 ac. $\times$ 100000$=$133225 sq. links;
$\sqrt{133225}=365$ links. *Ans.*

(3) Area of proposed square $=16\times12\frac{1}{4}$ sq. ft.;
$\therefore$ the side $=\sqrt{16\times\frac{49}{4}}=4\times\frac{7}{2}=14$ ft. *Ans.*

(4) $\sqrt{45^2+28^2}=\sqrt{2809}=53$ yds. *Ans.*

(5) $\sqrt{75^2-45^2}=\sqrt{(75+45)\times(75-45)}=\sqrt{120\times30}=60$ ft. *Ans.*

(6) $\sqrt{53^2-45^2}=\sqrt{98\times8}=\sqrt{49\times16}=7\times4=28$ in., the width;
$\therefore$ the area is 45×28 sq. in.$=8$ sq. ft. 108 in. *Ans.*

(7) Length of each side$=\sqrt{\frac{36^2}{2}}=\frac{36}{\sqrt{2}}=18\sqrt{2}=1{\cdot}4142\times18$
$=25{\cdot}456$ yds. nearly. *Ans.*
Area$=18\sqrt{2}\times18\sqrt{2}=324\times2=648$ sq. yds. *Ans.*

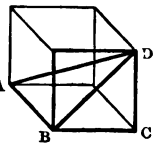
(8) $76\frac{2}{3}$ in.$=\frac{230}{3}$ in.; and 168 in.$=\frac{504}{3}$ in.; $230^2+504^2=52900+254016=306916$; the square root of which is 554; hence, $\frac{554}{3}=184\frac{2}{3}$ in.$=15$ ft. $4\frac{2}{3}$ in. *Ans.*

(9) A rectangle thrice as long as it is wide is evidently the sum of three squares, each having for a side the width of the rectangle; hence, $\frac{1}{3}$ of the given surface$=2$ sq. ft. 36 sq. in., or $2\frac{1}{4}$ sq. ft.$=$the area of each square; and $\sqrt{2\frac{1}{4}}=1\frac{1}{2}$ ft., the width of the rectangle; therefore the dimensions required are $4\frac{1}{2}$ ft. and $1\frac{1}{2}$ ft. *Ans.*

(10) A rectangle twice as long as it is broad is evidently divisible into two squares, each having for a side the breadth of the rectangle; hence, $\frac{1}{2}$ of $1364{\cdot}1954=682{\cdot}0977$ sq. yds.$=$the square of the width of the rectangle; also the square of its length is$=$twice the area of the rectangle, $=2728{\cdot}3908$; and the sum of the squares of the length and width, $=3410{\cdot}4885$, is the square of the diagonal; hence, $\sqrt{3410{\cdot}4885}=58{\cdot}4$ yds. nearly. *Ans.*

(11) Sum of the length and breadth$=\cdot1084+2=\cdot0542$ mi.
Difference of the length and breadth $=\cdot0206$
Hence, the length is$=\frac{1}{2}$ of $\cdot0748$
and the breadth $=\frac{1}{2}$ of $\cdot0336$
$\sqrt{(\cdot0374^2+\cdot0168^2)}=\sqrt{(\cdot00139876+\cdot00028224)}=\sqrt{\cdot001681}$
$=\cdot041$ of a mile. *Ans.*

(12) It will readily appear, in the annexed figure, that the square on BD, the diagonal of one of the faces, is$=$twice the square on one of the edges, BC or CD; and therefore the square on AD, the diagonal of the cube, being $=$the squares on AB and BD, is$=$thrice the square on one of the edges; or, the sides of the right-angled triangle, ABD, having for its hypotenuse the diagonal of the cube, are as $\sqrt{3}$, $\sqrt{2}$, and $\sqrt{1}$, or nearly as 1·732, 1·414, and 1; that is, the diagonal of a cube, the diagonal of one of its faces, and the length of its edge, are nearly in the proportions 1732, 1414, and 1000; which shows the



diagonal of the cube to be greater than that of the face by $\frac{318}{1000}$ of the length of the edge; and, since in the present instance that excess is ·53 of an inch, the length of the edge will be $=\cdot53 \div \cdot318 = 10 \div 6 = 1\frac{2}{3}$ inch, nearly. *Ans.*

CUBE ROOT.

Ex. 80.

(1) $\sqrt[3]{185193} = 57$ *Ans.*

125

157	7500	60193
	1099	
	8599	60193

$\sqrt[3]{24389} = 29$ *Ans.*

8

69	1200	16389
	621	
	1821	16389

(2) $\sqrt[3]{753571} = 91$ *Ans.*

729

271	24300	24571
	271	
	24571	24571

$\sqrt[3]{262144000} = 640$ *Ans.*

216

184	10800	46144
	736	
	11536	46144

(3) $\sqrt[3]{9938375} = 215$ *Ans.*

8

61	1200	1938
	61	
	1261	1261
	1	
635	132300	677375
	3175	
	135475	677375

$\sqrt[3]{12812904} = 234$ *Ans.*

8

63	1200	4812
	189	
	1389	4167
	9	
694	158700	645904
	2776	
	161476	645904

(4) $\sqrt[3]{481890304} = 784$ *Ans.*

343

218	14700	138890
	1744	
	16444	131552
	64	
2344	1825200	7338304
	9376	
	1834576	7338304

$\sqrt[3]{1295029} = 109$ *Ans.*

1000

309	30000	295029
	2781	
	32781	295029

(5) $\sqrt[3]{122763473} = 497$ *Ans.*

64

129	4800	58763
	1161	
	5961	53649
	81	
1477	720300	5114473
	10339	
	730639	5114473

(6) $\sqrt[3]{691329625} = 1905$ *Ans.*

1

39	300	5913
	351	
	651	5859
	81	
57	108300	54292
5705	10830000	54292625
	28525	
	10858525	54292625

(7) $\sqrt[3]{11914842304} = 2284$ *Ans.*

8

62	1200	3914
	124	
	1324	2648
	4	
668	145200	1266842
	5344	
	150544	1204352
	64	
6844	15595200	62490304
	27376	
	15622576	62490304

(8) $\sqrt[3]{2738124199} = 1399$ *Ans.*

1

33	300	1738
	99	
	399	1197
	9	
399	50700	541124
	3591	
	54291	488619
	81	
4179	5796300	52505199
	37611	
	5833911	52505199

(9) $\sqrt[3]{24414\cdot238701}=29\cdot01$ *Ans.*

		8	
69	1200	16414	
	621		
	1821	16389	
	81		
87	252300		25238
8701	25230000		25238701
	8701		
	25238701		25238701

(10) $\sqrt[3]{\cdot002460375}=\cdot135$ *Ans.*

		1	
33	300	1460	
	99		
	399	1197	
	9		
395	50700		263375
	1975		
	52675		263375

(11) $\sqrt[3]{73\cdot844800}=4\cdot1954$ nearly. *Ans.*

		64	
121	4800	9844	
	121		
	4921	4921	
	1		
1239	504300		4923800
	11151		
	515451		4639059
	81		
12575	52668300		284741000
	62875		
	52731175		263655875
			210851250

$\sqrt[3]{47\cdot000}=3\cdot6088$, &c. *Ans.*

		27	
96	2700	20000	
	576		
	3276	19656	
	36		
108	388800		344000
10808	38880000		344000000
	86464		
	38966464		311731712
	64		
	3905299200		32268288000

(12) $\sqrt[3]{213{\cdot}955}=5{\cdot}981$, &c. *Ans.*

	125		
159	7500	88955	
	1431		
	8931	80379	
	81		
1778	1044300	8576000	
	14224		
	1058524	8468192	
	64		
	107281200	107808000	

$\sqrt[3]{{\cdot}000100}={\cdot}0464$, &c. *Ans.*

64		
126	4800	36000
	756	
	5556	33336
	36	
1384	634800	2664000
	5536	
	640336	2561344
	16	
	645888	1026560

(13) $\sqrt[3]{{\cdot}148624}={\cdot}5297$ nearly. *Ans.*

125		
152	7500	23624
	304	
	7804	15608
	4	
1569	811200	8016000
	14121	
	825321	7427889
	81	
	839523	5881110

$\sqrt[3]{30{\cdot}500}=3{\cdot}124$, &c. *Ans.*

27		
91	2700	3500
	91	
	2791	2791
	1	
932	288300	709000
	1864	
	290164	580328
	4	
	292032	1286720

(14) $\sqrt[3]{}$ of $\frac{1}{8}$ of $7414875=\frac{1}{2}\sqrt[3]{7414875}=\frac{1}{2}$ of $195=97\frac{1}{2}$ *Ans.*

		1	
39	300	6414	
	351		
	651	5859	
	81		
575	108300	555875	
	2875		
	111175	555875	

(15) $\sqrt[3]{\frac{27}{64}}=\frac{\sqrt[3]{27}}{\sqrt[3]{64}}=\frac{3}{4}$ *Ans.*

$\sqrt[3]{\frac{189}{875}}=\sqrt[3]{\frac{27}{125}}=\frac{\sqrt[3]{27}}{\sqrt[3]{125}}=\frac{3}{5}$ *Ans.*

$\sqrt[3]{\frac{5}{9}}=\sqrt[3]{{\cdot}555555}$, &c. $={\cdot}82207$ *Ans.*

(16) $\sqrt[3]{}$ of $\frac{8}{27}=\frac{2}{3}$; and $\frac{2}{5}\sqrt[3]{2032\frac{296}{999}}=\frac{2}{5}\sqrt[3]{2032\frac{8}{27}}=\frac{2}{5}\sqrt[3]{\frac{54879}{27}}=\frac{2}{5}$ of $\frac{38}{3}$ $=\frac{76}{9}=8\cdot\dot{4}$. *Ans.*

Ex. 81.

(1) Solidity of the cube$=\frac{21}{4}\times\frac{14}{3}\times\frac{7}{3}$ cub. ft., $=\frac{7\times7\times7}{4}$; the cube root of which is$=7\div\sqrt[3]{4}=7\sqrt[3]{2}\div\sqrt[3]{8}=7\sqrt[3]{2}\div2$, or $\frac{7}{2}\sqrt[3]{2}$, $=4\cdot41$ ft. nearly. *Ans.*

(2) 361*s.* 6*d.*$\div$27*s.* 10*d.*$=4338d.\div334d.=12\cdot988$ cubic inches; the cube root of which is 2·3506 in. *Ans.*

(3) Edge of cube in feet$=\sqrt[3]{40000}=\sqrt[3]{8000}\times\sqrt[3]{5}=20\sqrt[3]{5}$; area of side in sq. ft.$=20\sqrt[3]{5}\times20\sqrt[3]{5}=400\sqrt[3]{25}=2\cdot924017\times400$ $=1169\cdot607$ sq. ft. nearly. *Ans.*

(4) 1 ton$=16$ oz.$\times2240=$weight of $16\times2\cdot24$ cub. ft. of water; $\sqrt[3]{16\times2\cdot24}=\sqrt[3]{\cdot512\times70}=\frac{4}{5}\sqrt[3]{70}$, the edge of the cistern in feet; $\therefore$ $\frac{4}{5}\sqrt[3]{70}\times\frac{4}{5}\sqrt[3]{70}\times5=\frac{16}{5}\sqrt[3]{4900}=16\cdot985\times\frac{16}{5}$ nearly, $=54\cdot352$ sq. ft. *Ans.*

(5) Their capacities being as 3 : 1, their edges are as $\sqrt[3]{3}$: $\sqrt[3]{1}$, or as 1·442 : 1 nearly, or as 721 : 500 nearly. *Ans.*

(6) Edge of the cube in inches$=\sqrt[3]{120}=4\cdot9324$; and from Ex. **80**, 12, it appears that the diagonal of a cube$=$the edge $\times\sqrt{3}$; hence, $4\cdot9324\times1\cdot73205=8\cdot543$ inches. *Ans.*

EXAMINATION PAPERS.

PAPER I.

(1) 54 ac. 29 po. 29¼ yds.

160

8669 po.

30¼

2167¼

260099¼

262266¼ yds.

9

2360398½ ft. *Ans.*

(2) £365 10*s.*$\div71\frac{3}{5}s.=7310s.\times3\div215s.=34\times3=102$ *Ans.*

(3) $\frac{15s.\ 11\frac{7}{8}d.\times38}{1s.\ 11\frac{5}{4}d.}=\frac{191\frac{7}{8}\times38}{23\frac{3}{4}}$ $=\frac{1535\times38}{190}=\frac{1535}{5}=307$ *Ans.*

(4) (i) 369 at £3 17*s.* 9*d.*

3

	1107
15*s.* 0*d.* = $\frac{1}{4}$ of £3	276 15 0
2 6 = $\frac{1}{9}$ of 15*s.*	46 2 6
0 3 = $\frac{1}{10}$ of 2*s.* 6*d.*	4 12 3

Ans. £1434 9*s.* 9*d.*

(ii) 7 cwt. 3 qrs. 18 lbs. at 1*s.* $8\frac{1}{2}$*d.* per cwt.

7

	11 $11\frac{1}{2}$
2 qrs. = $\frac{1}{2}$ of 1 cwt.	0 $10\frac{1}{2}$
1 qr. = $\frac{1}{2}$ of 2 qrs.	0 $5\frac{1}{4}$
16 lbs. = $\frac{1}{7}$ of 1 cwt.	0 $2\frac{3}{14}$
2 lbs. = $\frac{1}{8}$ of 16 lbs.	0 $0\frac{21}{112}$

Ans. 13*s.* $6\frac{10}{112}$*d.*

(5) Time for 27 men = $8\frac{1}{2}$ hours; do. for 1 man = $8\frac{1}{2}$ hrs. × 27; do. for 34 men = $\frac{1}{34}$ of $8\frac{1}{2}$ hrs. × 27 = $\frac{1}{4}$ hr. × 27 = $6\frac{3}{4}$ hrs. *Ans.*

(6) No. of quarters malt from 8 bu. × $45\frac{1}{2}$ = $46\frac{2}{3}$;

ditto from 1 bu. = $\frac{46\frac{2}{3}}{8\times45\frac{1}{2}}$;

ditto from 156 bu. = $\frac{46\frac{2}{3}\times156}{8\times45\frac{1}{2}}$

$$=\frac{140\times52}{4\times91}=\frac{35\times4}{7}=20 \text{ qu. } \textit{Ans.}$$

(7) $8\frac{1}{2}$ times $\frac{5}{100}=\frac{7}{40}$ of £249 11*s.* 8*d.*

$\frac{8}{40}=\frac{1}{5}$ =	49 18 4
$\frac{1}{40}=\frac{1}{8}$ =	6 4 $9\frac{1}{2}$
	£43 13 $6\frac{1}{2}$ *Ans.*

(8) Amt. of £1 in 3 yrs. = $\left(\frac{104\frac{1}{2}}{100}\right)^3=\left(\frac{2\cdot09}{2}\right)^3=\frac{9\cdot129329}{8}$; which

× 2670 = 91·29329 × 267 ÷ 8 = £3046·91355$\frac{3}{8}$

= £3046 18*s.* 3·2529*d.* *Ans.*

(9) (i) $\frac{3745}{80\frac{1}{4}}=\frac{14980}{321}=\frac{140}{3}$ cents at £$3\frac{1}{4}$=£$13\times35+3$
=£151 13*s.* 4*d.* income. *Ans.*

(ii) Int. on $80\frac{1}{4}=3\frac{1}{4}$; ditto on $1=\frac{3\frac{1}{4}}{80\frac{1}{4}}=\frac{13}{321}$;
do. on $100=\frac{1300}{321}=4{\cdot}05$ p. c. nearly. *Ans.*

(iii) $\frac{140}{3}$ cents=£$100\times\frac{140}{3}$=£4666 13*s.* 4*d.* stock. *Ans.*

(iv) Gain on each cent=$83\frac{3}{8}-80\frac{1}{4}=3\frac{1}{8}$;
∴ gain on $\frac{140}{3}$ cents=£$\frac{25}{8}\times\frac{140}{3}$=£145 16*s.* 8*d.* *Ans.*

(10) 3·65*s.* : 10·8*d.* :: ·03577 c. ft.,
or 365*s.* : 90*s.* :: ·03577 c. ft. : ·00882 c. ft. *Ans.*

90
365 | 3·21930
·00882

(11) Int. on $100=3\frac{1}{2}\times2\frac{1}{2}=8\frac{3}{4}$; ∴ 100 is the present worth of $108\frac{3}{4}$; or 400 is that of 435; or 80 is that of 87; hence, $\frac{80}{87}$ of £1450=$\frac{80}{3}$ of £50=£$1333\frac{1}{3}$. *Ans.*

(12) $\sqrt{841{\cdot}50}=29{\cdot}0086$ *Ans.*

4
49 | 441
441
58008 | 500000
464064
580166 | 3593600
3480996
112604

$\sqrt[3]{841{\cdot}500}=9{\cdot}441$ *Ans.*

729
274 | 24300 | 112500
1096
25396 | 101584
16
2824 | 2650800 | 10916000
11296
2662096 | 10648384
2676160

(13) $\frac{5\frac{1}{4}+\frac{3}{11}\text{ of }12\frac{5}{6}}{3\frac{1}{2}-(1\frac{2}{3}+\frac{7}{10}+\frac{2}{15})}=\frac{5\frac{1}{4}+3\frac{1}{2}}{3\frac{1}{2}-2\frac{1}{2}}=\frac{8\frac{3}{4}}{1}=8\frac{3}{4}$ *Ans.*

(14) If *A* be said to do 1 measure of work per day, the whole work will be=14 such measures; therefore *B* does $\frac{1}{16}$ of 14 $=\frac{7}{8}$ meas. per day; and *A* and *B* together do $1\frac{7}{8}$ meas. per day, or the whole work in $14\div1\frac{7}{8}=7\frac{7}{15}$ days. *Ans.*

(15) 1 lb. of candles is worth $\frac{11\frac{1}{2}}{12}s.$; $\therefore$ 57 lbs. of candles are worth $\frac{45s.\times 57}{12\times 4}$=value of oil at $\frac{95s.}{22}$ per gallon; hence, $\frac{45\times 57}{12\times 4}\div\frac{95}{22}$ $=\frac{9\times 3}{48}\times 22=\frac{297}{24}=12\frac{3}{8}$ gall., or 12 gall. 3 pints. *Ans.*

(16) $1186\frac{1}{4}$ yds. at $\frac{441}{73}d.=\frac{441}{73}d.\times\frac{4745}{4}=\frac{441d.\times 65}{4}$;

$330\frac{3}{4}$ yds. at $\frac{346}{49}d.=\frac{346}{49}d.\times\frac{1323}{4}=\frac{346d.\times 27}{4}$;

1517 yds. sold for $\frac{28665d.+9342d.}{4}=9501\frac{3}{4}d.$

1517 yds. bought for $\frac{225}{37}\times 1517$ $=9225d.$

Gain on $9225d.=\overline{276\frac{3}{4}d.}$

$9225 : 100 :: 276{\cdot}75 : \frac{27675}{9225}=3$ p. c. *Ans.*

(17) £5400 $=1\frac{4}{5}$ of T's capital; $\therefore$ T's capital $=$ £5400 $\div 1\frac{4}{5}$ $=$£3000, and M's=£2400.

T's whole gain=£450

12 mths. int. on £3000 at 5 p. c.= 150

Half the trade profit=£300

$\therefore$ £400 − £300=£100=M's interest on £2400;

now 12 mths. int. on £2400=£120; $\therefore$ £120 : £100 :: 12 mths. : 10 mths.; so that M's capital was invested 10 mths., or was paid in 2 mths. after the beginning of the year, viz. at the beginning of March. *Ans.*

(18) The prices per quart of sack, claret, and muscadel were as 1, $1+1\frac{1}{4}$, and $1+\frac{3}{4}$, or as 1, $\frac{4}{5}$, and $\frac{4}{3}$, or as 15, 12, and 20; and the quantities consumed were as 3, $\frac{5}{12}$ of 3, and 1, or as 12, 5, and 4. Hence, the amounts for these several wines were as 15×12, 12×5, and 20×4, or as 180, 60, and 80, or as 9, 3, and 4; so that the whole quantity of sack cost $\frac{9}{16}$ of 10*s.* $=5\frac{5}{8}s.$ Now the quantities of claret and muscadel being as 5 : 4, that of claret was $\frac{1}{4}$ more than that of muscadel, and $\therefore$ $\frac{1}{4}$ of the muscadel$=1\frac{1}{2}$ pt., or the whole quantity of muscadel=6 pts.=3 qts., and $\therefore$ the whole quantity of sack =3 qts. $\times 3$=9 qts., which cost $5\frac{5}{8}s.$, or 72 qts. sack cost 45*s.*, or 6 qts. cost 45*d.*, or 1 qt. cost $7\frac{1}{2}d.$ *Ans.*

PAPER II.

(1) £20÷7*s.* 11*d.*=240*d.*×20÷95*d.*=50$\frac{10}{19}$, or 50 men can be paid, leaving a surplus of $\frac{10}{19}$ of 95*d.*=4*s.* 2*d.* *Ans.*

(2) The profit on the whole, viz. 27*s.*, is equal to the profit on each article, viz. (1*s.* 9*d.* − 1*s.* 4$\frac{1}{2}$*d.*), multiplied by the number of articles; hence, 27*s.*÷4$\frac{1}{2}$*d.*=27*s.*÷$\frac{3}{8}$*s.*=9×8=72. *Ans.*

(3) No. of acres by 3 men in 5$\frac{1}{4}$ da.=12$\frac{1}{4}$ ac.

No. of acres by 1 man in 1 da.=$\frac{12\frac{1}{4}}{3\times5\frac{1}{4}}$

No. of acres by 8 men in 6 da.=$\frac{12\frac{1}{4}\times8\times6}{3\times5\frac{1}{4}}$

$=\frac{49\times8\times6}{3\times21}=7\times8\times2\div3=37\frac{1}{3}$ days. *Ans.*

(4) From March 12 to July 31=141 da.=$\frac{141}{365}$ of a year; hence, $\frac{141}{365}$ of $\frac{3\frac{1}{4}}{100}$ of £599 8*s.* 1*d.*=$\frac{143857d.\times13\times141}{146000}$=1806·095*d.*

=£7 10*s.* 6·095*d.* *Ans.*

(5) 29·37÷·2035=293700÷2035=144$\frac{660}{2035}$; which means that the given divisor ·2035 is contained 144 times together with $\frac{660}{2035}$ of once, and $\frac{660}{2035}$ of once ·2035 is=$\frac{660}{10000}$ or ·066, the remainder. *Ans.*

(6) 28 yds. 2 qrs. 2$\frac{1}{2}$ nls. : 37·8 yds. :: £9 0*s.* 9$\frac{11}{16}$*d.*

4 — 20

114 — 180

4 — 12

458·5 nls. : 37·8×4×4 nls. :: 2169$\frac{11}{16}$*d.*

$:\frac{34715d.\times378}{4585}=\frac{6943d.\times54}{131}=53d.\times54=$£11 18*s.* 6*d.* *Ans.*

(7) If the apples were 105*d.* each, the pears would be 126*d.* each; then 5 dozen pears would cost 126*d.*×60; and the number of apples amounting to that sum would be 126*d.*×60÷105*d.* =6*d.*×60÷5*d.*=72=6 dozen apples. *Ans.*

(8) 6 f. 39 po. 5 yds. $0\frac{1}{2}$ ft. | 7 f. 3 po. 3 yds. $2\frac{1}{2}$ ft.

40 | 40
279 | 283
$5\frac{1}{2}$ | $5\frac{1}{2}$
$1391\frac{1}{2}$ | $1411\frac{1}{2}$
1400 | 1418
$1539\frac{1}{2}$ | $1559\frac{1}{2}$
3 | 3
4619 ft. | 4681 ft.

$\frac{4619 \text{ ft.}}{4681 \text{ ft.}} = \frac{149}{151}$ *Ans.*

(9) $\frac{6\frac{3}{7}+\frac{3}{4} \text{ of } \frac{3}{7}-\frac{7}{45} \text{ of } 2\frac{1}{2}}{4\frac{3}{8}+\frac{6}{13} \text{ of } 9\frac{1}{3}+\frac{1}{8}} = \frac{6+1\frac{3}{4} \text{ of } \frac{3}{7}-\frac{7}{9} \text{ of } \frac{1}{2}}{4\frac{1}{2}+\frac{2}{13} \text{ of } 28} = \frac{6+\frac{3}{4}-\frac{7}{18}}{\frac{9}{2}+\frac{56}{13}}$

$= 6\frac{13}{36} \div \frac{229}{26} = \frac{1}{36} \div \frac{1}{26} = \frac{13}{18}$ *Ans.*

(10) $\frac{987654320}{999999999} = \frac{12345679 \times 80}{12345679 \times 81} = \frac{80}{81}$ *Ans.*

$\cdot 97\frac{531}{999} = \frac{1}{100} \text{ of } 97\frac{59}{111} = \frac{10826}{11100} = \frac{5413}{5550}$ *Ans.*

(11) $\frac{1280}{100}$ cents at £$4\frac{1}{2}$ = £$4\frac{1}{2} \times 12{\cdot}8$ = £57·6 or £57 12*s.*, the 1st income; 12·8 cents sold out at $85\frac{5}{8}$ to buy 6 per cent. stock at $68\frac{1}{2}$ obtains $\frac{12{\cdot}8 \times 85\frac{5}{8}}{68\frac{1}{2}}$ cents at £6 = $\frac{£6 \times 12{\cdot}8 \times 685}{137 \times 4}$ = £6 × 3·2 × 5 = £6 × 16 = £96, the 2nd income; £96 − £57 12*s.* = £38 8*s.* increase. *Ans.*

(12) Int. on 100 = $4\frac{1}{4} \times 4 = 17$; ∴ 100 would amount to 117; and $\frac{100}{117}$ of £975 0*s.* 9*d.* = £8 6*s.* 9*d.* × 100 = £833 15*s.* *Ans.*

(13) The respective gains are $\frac{27-21}{21}$ and $\frac{4-3}{3}$ of the prime cost; $\frac{6}{21}$ and $\frac{1}{3}$ of 100 = $\frac{600}{21}$ and $\frac{700}{21}$ per cent.; the difference of which is $\frac{100}{21} = 4\frac{16}{21}$ per cent. *Ans.*

(14) *A*'s share is = $\frac{\sqrt{41}}{\sqrt{53}}$ of *B*'s = $\sqrt{\frac{41}{53}}$, or nearly $\sqrt{\cdot 7736}$ of *B*'s; $\sqrt{\cdot 7736} = \cdot 8795$ nearly; so that *A*'s share is to *B*'s nearly as ·8795 : 1; hence, £10685 ÷ 1·8795 = £5685, *B*'s share; ∴ *A*'s = £5000. *Ans.*

(15) Circuit of walls (17 + 13) × 2 = 60 ft.; surface to be covered = 60 sq. ft. × $11\frac{1}{2} = \frac{25}{12}$ sq. ft. × length of paper in feet; ∴ the length of paper in yards = $20 \times 11\frac{1}{2} \div \frac{25}{12} = \frac{230 \times 12}{25} = 552 \div 5$ = $110\frac{2}{5}$ yds. *Ans.*

(16)
$$10\tfrac{3}{4}\times 2 = \begin{array}{ll} 82{\cdot}45 & 52{\cdot}8 \\ 21{\cdot}50 & 21{\cdot}5 \end{array}$$

The lawn and surrounding area $= 103{\cdot}95 \times 74{\cdot}3 = 7723{\cdot}485$ sq.ft.
The lawn alone $= 82{\cdot}45 \times 52{\cdot}8 = 4353{\cdot}360$
area to be paved $= 3370{\cdot}125$ sq.ft.
each flag-stone $= 4{\cdot}94 \times 3{\cdot}74 = 18{\cdot}4756$ sq. ft.;
$\therefore$ no. of stones $= 33701250 \div 184756 = 182\frac{181}{442}$ st. *Ans.*

(17) Amount of 196 gall. at $\frac{102d.}{7} \times \frac{125}{100}$ per gall.
$= 102d. \times 5 \times 7 = 3570d.$
180 gall. sold at $\frac{91d.}{5} = 3276d.$
16 gall. to be sold for $294d.$
$\therefore$ at $294d. \div 16 = 18\frac{3}{8}d.$ per gallon. *Ans.*

(18) $\frac{3}{8}$ lb. tea gains $\frac{24}{100}$ of $\frac{3}{8}$ lb. tea $= \frac{2}{9}$ lb. coffee; or $\frac{9}{100}$ lb. tea $= \frac{2}{9}$ lb. coffee; $\therefore \frac{9}{100} \div \frac{2}{9}$ or $\frac{81}{200}$ lb. tea $= 1$ lb. coffee; $\therefore \frac{5}{6}$ lb. coffee $= \frac{5}{6}$ of $\frac{81}{200}$ tea $= \frac{27}{80}$ lb. tea. Now we have to find what fraction of the value of a lb. of tea will be gained by an outlay $= \frac{27}{80}$ lb. tea, the rate of gain being 24 per cent.; hence, 100 : 24 :: $\frac{27}{80}$ lb. tea : $\frac{81}{1000}$ or ·081. *Ans.*

Paper III.

(1) $963\frac{3}{6}$ tons : $182\frac{1}{2}$ tons, or 963·6 : 182·5,
or 132 : 25 :: £$6745\frac{3}{4}$: $\frac{£26983 \times 25}{132 \times 4} = £2453 \times 100 \div 192$
$= £1277\ 12s.\ 1d.$ *Ans.*

(2) Difference of prices of an apple $= \frac{10\frac{1}{2}}{5} - \frac{13\frac{1}{2}}{7} = \frac{6}{35}d.$; hence, $\frac{6}{35}d. \times 21 = \frac{18}{5}d. = 3\frac{3}{5}d.$ *Ans.*

(3)
$$\begin{array}{r|lll} & \text{cwt.} & \text{qr.} & \text{lbs.} \\ 65\frac{7}{8}) & 725 & 1 & 16\frac{4}{8} \\ & & & 8 \\ \hline 527) & 5803 & 0 & 22\frac{2}{8} \\ & 11 & 0 & 1\frac{27}{88} \end{array}$$

$$\begin{array}{r|ll} & \text{cwt.} & \text{lbs.} \\ & 6 & 8\frac{2}{8}) \\ & 112 & \\ \hline & 680\frac{2}{5} & \\ & 5 & \\ \hline 3402 & & \end{array} \qquad \begin{array}{r|ll} & \text{cwt.} & \text{lbs.} \\ & 11 & 1\frac{27}{88} \\ & 112 & \\ \hline & 1233\frac{27}{88} & \\ & 5 & \\ \hline) & 6166\frac{10}{17} & \\ & & 1\frac{378}{459} \end{array}$$

Ans.

(4) Whole interest on $100 = 4\frac{1}{2} \times 3\frac{1}{4}$;

$$\frac{9}{2} \times \frac{13}{4} : 100 :: £80\ 6s.\ 3\frac{3}{4}d.$$

$$: \frac{£80\ 6s.\ 3\frac{3}{4}d. \times 100 \times 4 \times 2}{9 \times 13} = \frac{£642\ 10s.\ 6d. \times 100}{9 \times 13}$$

$$= £549\ 3s.\ 4d.\ \textit{Ans.}$$

(5) $165\frac{1}{6} \times 11\frac{2}{7} = \frac{991}{6} \times \frac{79}{7} = \frac{78289}{42}$;

hence, $\frac{78289}{42} + \frac{1}{6} + \frac{6}{7} + \frac{20}{21} = \frac{78289+7+36+40}{42} = \frac{78372}{42}$

$$= 1866\ \textit{Ans.}$$

(6)

cwt.	qrs.	lbs.		cwt.		£
13	3	17	:	29·41	::	$29\frac{4}{7}$
		7				7
97	1	7				207

or $389\frac{1}{4}$ qrs. : 29·41 × 4 qrs. :: £207

$$: \frac{£207 \times 2941 \times 4 \times 4}{155700} = \frac{£23 \times 17 \times 16}{100} = £62{\cdot}56 = £62\ 11s.\ 2\frac{2}{5}d.$$

Ans.

(7) $$\frac{10{\cdot}738 + \frac{2}{5} \text{ of } (1 - {\cdot}009)}{76\frac{8}{17} \text{ of } 63\frac{3}{19} \text{ of } 2{\cdot}907 \times {\cdot}0059}$$

$$= \frac{10738 \times 9}{182} \times \frac{17}{1300} \times \frac{19}{1200} \times \frac{1000}{2907} \times \frac{10000}{59}$$

$$= \frac{59 \times 9 \times 17}{13} \times \frac{19000}{12 \times 2907} \times \frac{1}{59} = \frac{9 \times 17}{13} \times \frac{1000}{12 \times 153}$$

$$= \frac{1000}{12 \times 13} = \frac{250}{39} = 6\frac{16}{39}\ \textit{Ans.}$$

(8)

sq. ft.	′	″	
17	3	3	
14	8	11	
241	9	6	
11	6	2	
1	3	9	$11\frac{3}{4}$
9) 254	7′	5″	$11\frac{3}{4}$‴ *Ans.*
	12		

Here $11\frac{3}{4}''' = \frac{11\frac{3}{4}}{12}$ of 1″

$= \frac{47}{48}$ of 1″.

or 28 sq. yds. 2 sq. ft. $89\frac{47}{48}$ sq. in.

(9) Given 23*s.* 10*d.* $=\frac{97\frac{1}{2}}{100}$ of the prime cost, to find what sum would be $\frac{101\frac{1}{4}}{100}$ of the prime cost:

$$\begin{array}{rcl} 97\frac{1}{2} : 101\frac{1}{4} & :: & 23s.\ 10d. \\ 4 \quad\ 4 & & 12 \\ \hline \text{or } 390 : 405 & :: & 286d. \\ \text{or } \quad 1 : \ 27 & :: & 11d. : 297d. = 24s.\ 9d. \end{array}$$

Ans.

(10) 375 meas. done in 15 days by 14×3 boys;

$\therefore$ 1 meas. done in 1 day by $\frac{14\times3\times15}{375}$ boys;

$\therefore$ 350 meas. done in 21 days by $\frac{14\times3\times15\times350}{375\times21}$ boys $=8$ men;

$\therefore$ 1 man $=\frac{14\times3\times15\times350}{375\times21\times8}$ boys $=3\frac{1}{2}$ boys;

that is, the men must be $3\frac{1}{2}$ times as expert as boys. *Ans.*

(11) *B*'s share will be 1 sum

A's $=1\frac{1}{3}$ of it

C's $=1\frac{1}{3}$ of it $-$ £3 3*s.*

£12 16*s.* $=$ $3\frac{2}{3}$ of *B*'s share $-$ £3 3*s.*

3 3

£15 19 $+3\frac{2}{3}=$ £47 17*s.* $\div 11=$ £4 7*s.* to *B*

$1\frac{1}{3}$ of £4 7*s.* $=$ 5 16*s.* to *A*

£5 16*s.* $-$ £3 3*s.* $=$ 2 13*s.* to *C*

Ans.

(12) If *A* be said to do 1 measure of work per day, the whole work consists of $27\frac{1}{2}$ such measures; and *B*, *C*, *D* in 1 day will do respectively $\frac{27\frac{1}{2}}{32\frac{1}{2}}$, $\frac{27\frac{1}{2}}{33}$, and $\frac{27\frac{1}{2}}{39}$, or $\frac{11}{13}$, $\frac{5}{6}$, and $\frac{55}{78}$ of a measure; hence, all four together do $1+\frac{11}{13}+\frac{5}{6}+\frac{55}{78}=3\frac{5}{13}$ meas. in 1 day, or the whole work in $27\frac{1}{2}\div3\frac{5}{13}=\frac{55}{2}\times\frac{13}{44}=\frac{65}{8}=8\frac{1}{8}$ da. *Ans.*

(13) $2\sqrt{2}=2{\cdot}8284$

$\sqrt{7}=2{\cdot}6457$

$\cdot1827 : 2{\cdot}6457 :: 16s.\ 11d.$

$\therefore \frac{203d.\times26457}{1827}=\frac{26457d.}{9}=2940d.$ nearly $=$ £12 5*s.* nearly.

Ans.

(14) 13·97 gall. at $\frac{£8\frac{1}{2}}{11}$ = £8·5 × 1·27 = £10·795

6·75 gall. at $\frac{£4\frac{1}{2}}{5}$ = £4 2 × 1·35 = 5·670

20·72 gall. are to be sold for £16·465 × $\frac{112}{100}$;

∴ 1 gall. sold for $\frac{£16·465 \times 1·12}{20·72}$ = £·89 = 17*s.* $9\frac{5}{8}$*d.*

= £4 9*s.* for 5 gall. *Ans.*

(15) If *A* be said to do 1 measure of work per hour, the whole work consists of 25 such measures; and *A* and *B* together do $25 \div 14\frac{7}{12} = 1\frac{5}{7}$ meas. per hour; hence, *B* does $1\frac{5}{7} - 1 = \frac{5}{7}$ meas. per hour, or the whole work in $25 \div \frac{5}{7} = 5 \times 7 = 35$ hours. *Ans.*

(16) *B*'s share is $\frac{100}{105}$ of *A*'s, and *A*'s is $\frac{94}{100}$ of *C*'s; if, therefore, 100 be the proportional no. for *C*, that of *A* will be 94, and that of *B* will be $\frac{100}{105}$ of $94 = \frac{1880}{21}$; or the shares of *A*, *B*, *C* are as 94 × 21, 1880, and 100 × 21, that is, as 987, 940, and 1050; sum, 2977; accordingly,

$\frac{2290s.}{2977}$, or $\frac{10s.}{13}$, × 987, 940, and 1050, gives to *A* £37 19*s.* $2\frac{10}{13}$*d.*

to *B* 36 3 $0\frac{12}{13}$

to *C* 40 7 $8\frac{4}{13}$

Ans.

(17) 56 gallons in which $\frac{4}{5}$ of the whole is brandy costs £84; and it is required to find how many gallons in which $\frac{5}{6}$ of the whole is brandy should cost £75.

The proportions of strength, then, are as $\frac{4}{5} : \frac{5}{6}$, or 24 : 25; and accordingly we may state as follows:

£84 : £75
25 : 24
:: 56 gall. : $\frac{56 \text{ gall.} \times 75 \times 24}{84 \times 25}$

= 2 gall. × 24 = 48 gall. *Ans.*

(18) £75 × $\frac{110}{100}$ = £82·5 = the present worth of the selling price for 2 mths. at 5 per cent. per annum.

Int. on 100 for 2 mths. = $\frac{1}{6}$ of 5 = $\frac{5}{6}$;

100 : $100\frac{5}{6}$ :: £82·5 : £83·1875, credit selling price of 66 barrels, which is, per barrel, = £1·260$4\frac{1}{6}$ = £1 5*s.* $2\frac{1}{2}$*d.* *Ans.*

PAPER IV.

(1) 237 tons coals at 15s. 7d.=£184 13s. 3d.

	2	8	3
27)	182	5	0
	£6	15	0

Ans.

(2) £11 18s. 4d. : £9 13s. 5d. :: $35\frac{3}{7}$ yds.
or, 2360d. × 7 : 2321d. :: 247 yds.
or, 20 × 7 : 211 :: 19 yds. : $28\frac{69}{140}$ yds. *Ans.*

(3) No. of men to do the work in $8\frac{1}{2} \times 13$ hrs.=18
No. of men to do the work in 1 hr. $=18 \times 8\frac{1}{2} \times 13$
No. of men to do the work in $9\frac{3}{4} \times 17$ hrs.$=\frac{18 \times 8\frac{1}{2} \times 13}{9\frac{3}{4} \times 17}$

$$=\frac{18 \times 34 \times 13}{39 \times 17}=6 \times 2=12 \text{ men. } \textit{Ans.}$$

(4) (i) 5701 at 11s. $6\frac{3}{4}$d.

	2850	10	
10s. 0d. $=\frac{1}{2}$ of £1	356	6	3
1 3 $=\frac{1}{8}$ of 10s.	89	1	$6\frac{3}{4}$
0 $3\frac{3}{4}$ $=\frac{1}{4}$ of 1s. 3d.			

Ans. £3295 17s. $9\frac{3}{4}$d.

(ii) 7 gall. 3 qts. $1\frac{7}{8}$ pts. at £1 12s. 9d.

	11	9	3
3 qts. 1 pt. $=\frac{1}{8}$ of 7 gall.	1	8	$7\frac{7}{8}$
$0\frac{7}{8}$ $=\frac{1}{8}$ of $3\frac{1}{2}$ qts.	0	3	$6\frac{63}{64}$

Ans. £13 1s. $5\frac{55}{64}$d.

(5) No. of square yards to cover an area $10\frac{1}{2}$ ft. broad$=87\frac{1}{2} \times \frac{3}{4}$
No. of square yards to cover an area 1 ft. broad$=\frac{87\frac{1}{2} \times \frac{3}{4}}{10\frac{1}{2}}$
No. of square yards to cover an area 10 ft. broad$=\frac{87\frac{1}{2} \times \frac{3}{4} \times 10}{10\frac{1}{2}}$

$$=\frac{175 \times 3 \times 5}{42}=\frac{25 \times 5}{2}=62\frac{1}{2} \text{ sq. yds.; and the width being}$$

1 yd., the length will be $62\frac{1}{2}$ yds. *Ans.*

(6) The capitals of A, B, C are as 340, 289, and 187, or as 20, 17, and 11; sum, 48; therefore £1425 $\times \frac{20}{48}$, $\frac{17}{48}$, and $\frac{11}{48}$ gives to A £593 15*s.*, to B £504 13*s.* 9*d.*, to C £326 11*s.* 3*d.* *Ans.*

(7) 10 boys=6 men; $\therefore$ 1 boy=$\frac{6}{10}$ of 1 man; and 5 men with 7 boys=5 men+$\frac{6}{10}\times 7$ men=$9\frac{1}{5}$ men;

No. of days for 6 men to do the work=$11\frac{1}{2}$

No. of days for 1 man to do the work=$11\frac{1}{2}\times 6$

No. of days for $9\frac{1}{5}$ men to do the work=$\frac{11\frac{1}{2}\times 6}{9\frac{1}{5}}$

$$=\frac{23\times 3\times 5}{46}=7\tfrac{1}{2}\ \textit{Ans.}$$

(8) Int. for $2\frac{1}{2}$ yrs.=$\frac{\text{£6 } 7s.\ 8{\cdot}9d.}{\text{£63 } 17s.\ 5d.}$ of the principal;

Int. for 1 yr. =$\frac{1532{\cdot}9}{15329\times 2\frac{1}{2}}=\frac{1}{25}$ of the principal;

$\therefore$ $\frac{1}{25}$ of 100—4 per cent. per annum. *Ans.*

(9) $44\frac{4}{9}$ qrs. barley increased by $3\frac{1}{2}$ p.c.=$\frac{400}{9}\times\frac{103\frac{1}{2}}{100}=\frac{414}{9}=46$ qrs. malt. *Ans.*

(10) If F be said to do 1 measure of work per hour, the whole work is = 28 such measures; and F and G together do $\frac{28}{14\frac{14}{15}}$ $\frac{4\times 15}{32}=\frac{15}{8}=1\frac{7}{8}$ measures per hour; so that G does $1\frac{7}{8}-1$, or $\frac{7}{8}$ of a measure in 1 hour, or the whole work in $28\div\frac{7}{8}=4\times 8$ =32 hours. *Ans.*

(11) 1 *rupee* 10 *annas*, or $1\frac{5}{8}$ *rupees*, at $\frac{15s.\ 9d.}{8}=\frac{63s.\times 13}{32\times 8}$. In India 1 of the articles costs $\frac{1}{5}$ of $\frac{63s.\times 13}{32\times 8}$, or 12×40 of them cost $\frac{12\times 40}{5}$ of $\frac{63s.\times 13}{32\times 8}=\frac{63s.\times 13\times 3}{8}$; and in England 1 article costs 13*s.* 6*d.*+4=$3\frac{3}{8}$*s.*

$\therefore$ $\frac{63s.\times 13\times 3}{8}\div 3\frac{3}{8}s.=\frac{63\times 13\times 3}{27}=7\times 13=91$ *Ans.*

(12) If A be said to do 1 measure of the work per minute, the whole work is $=36$ such measures; and B does $\frac{1}{28}$ of $36=1\frac{2}{7}$ measures per minute.

$\therefore$ C would do $1\frac{2}{7}+1$ or $2\frac{2}{7}$ measures per minute;
D „ „ $1\frac{2}{7}-1$ or $\frac{2}{7}$ measure „ „ ;
hence, C would do the work in $36\div 2\frac{2}{7}=15\frac{3}{4}$ min.,
and D „ „ „ $36\div\frac{2}{7}=126'=2\frac{1}{10}$ hrs. } *Ans.*

(13) A's share is $\frac{\sqrt[3]{3}}{\sqrt[3]{4}}$ of B's; $\sqrt[3]{3}\div\sqrt[3]{4}=\sqrt[3]{\frac{3}{4}}=\sqrt[3]{\cdot75}=\cdot90856$ nearly; or A's share is $\cdot90856$ of B's;
hence, £28 13*s.* 4*d.* $\times\cdot90856=$£26 0*s.* $10\frac{3}{4}$*d.* to A. *Ans.*

$$\begin{array}{r} 28 \\ \hline 25\cdot43968 \\ 6s.\ 8d.=\frac{1}{3}= \ 0\cdot30285 \\ 6s.\ 8d.=\frac{1}{3}= \ 0\cdot30285 \\ \hline £26\cdot04538 \end{array}$$

(14) $$\frac{\sqrt{8\frac{11}{14}+6\frac{20}{21}}+\sqrt{8\frac{11}{14}-6\frac{20}{21}}}{\cdot00011581\div\cdot0037}=\frac{\sqrt{15\frac{31}{42}}+\sqrt{1\frac{5}{6}}}{1\cdot1581\div37}$$

$$\frac{\sqrt{15\cdot7381}+\sqrt{1\cdot8333}}{\cdot0313}=\frac{3\cdot967+1\cdot354}{\cdot0313}=\frac{53210}{313}=170 \text{ nearly.}$$ *Ans.*

(15) In 1st set, 28 men can do 832 yds. in $9\frac{3}{4}$ hrs. $\times 3$,
or 1 man can do $\frac{832}{28\times9\frac{3}{4}\times3}$ yds. in 1 hr.

In 2nd set, 33 men can do 1408 yds. in $10\frac{1}{2}$ hrs. $\times 5$,
or 1 man can do $\frac{1408}{33\times10\frac{1}{2}\times5}$ yds. in 1 hr.

The average abilities, therefore, are as $\frac{832}{7\times39\times3}:\frac{1408\times2}{33\times21\times5}$,
or as $\frac{52}{39}:\frac{176}{33\times5}$, or as $\frac{4}{3}:\frac{16}{15}$, or as $\frac{5}{15}:\frac{4}{15}$, or as $5:4$ *Ans.*

(16) The required quantity of barley $\times\frac{82\frac{1}{2}}{100}=22$ stones;

$$\therefore 22 \text{ st.}\div\frac{82\frac{1}{2}}{100}=\frac{2200}{82\cdot5}=\frac{80}{3}=26\tfrac{2}{3} \text{ st. } \textit{Ans.}$$

(17) £242 9*s.* 9·4*d.*
£2076 12 3*d.*, if × the amount of 1 for 3 years, would produce
£2319 2 0·4*d.*

∴ 556584·4*d.* ÷ 498387*d.* = 1·1167715, the amount of 1 in 3 yrs.; ∴ $\sqrt[3]{1{\cdot}1167715} = 1{\cdot}0375$, the amount of 1 in 1 yr.; or the rate is 3·75, or $3\frac{3}{4}$ p. c. *Ans.*

(18) For every $77\frac{5}{8}$ originally invested, he in the first instance received an income of £3; but after selling out and reinvesting he obtained $£5 \times \frac{82\frac{1}{2}}{96} = \frac{£275}{64}$; so that the 1st is to the 2nd income as £3 × 64 : £275, or 192 : 275, showing an addition $= \frac{83}{192}$ of the 1st income = £41½; ∴ $\frac{1}{96}$ of the 1st income = £1, or the 1st income was £96, and the original investment $= £\frac{96}{3} \times 77\frac{5}{8} = £2484$ *Ans.*

Paper V.

(1) 2 mi. 7 f. 35 po.
8
23 f.
40
955 po. = 12 in. × 3 × 5½ × 955 = 198 × 955 in.
189090 in. ÷ 39·371 in. = 189090000 ÷ 39371 = 4802·8 mètres nearly. *Ans.*

(2) Capacity of box $(3\frac{1}{3} \times 2\frac{11}{12})$ cub. ft. × $1\frac{1}{6}$
$\frac{227}{112}$ cwt. × $\frac{10}{3} \times \frac{35}{12} \times \frac{7}{6} = \frac{103 \times 175}{16 \times 12} = \frac{18025}{192} = 93\frac{169}{192}$ cwt. *Ans.*

(3) 9*d.* = $\frac{3}{5}$ of the prime cost; ∴ the prime cost is 9*d.* ÷ $\frac{3}{5}$ = 3*d.* × 5 = 15*d.* *Ans.*

(4) 2 dozen articles bought for $17\frac{1}{2}d.$ is at $8\frac{3}{4}d.$ per dozen, which with 10 p. c. added $= \frac{35}{4}d. \times \frac{110}{100} = \frac{77}{8}d. = 9\frac{5}{8}d.$ per dozen.

24 at	$9\frac{5}{8}d.$	231*d.*
8 „	9*d.* =	72
7 „	$10\frac{1}{2}d.$	$73\frac{1}{2}$
9 „	$85\frac{1}{2}d. \div 9$ =	$85\frac{1}{2}d.$

∴ $85\frac{1}{2}d. \div 9 = 9\frac{1}{2}d.$ per dozen. *Ans.*

(5) The interest for the required time is $=\frac{168\cdot3}{12410}$ of the principal, or $\frac{99}{7300}$ of it; $\therefore$ $\frac{99}{7300}$ of $100=\frac{99}{73}$, the int. on 100 for the required time.

$3\frac{3}{3} : \frac{99}{73} :: 365$ da. $: \frac{365 \text{ da.} \times 99 \times 3}{73 \times 11} = 135$ days. *Ans.*

(6) 3 men for 4 days = 1 man for 12 days;
8 boys for 9 days = 1 boy for 72 days;
and, since $12 : 72 :: 1 : 6$,
$\therefore$ the wages of a man for 1 day = the wages of a boy for 6 da. *Ans.*

(7) $\frac{\cdot035}{14\frac{5}{6}} \times \frac{2\cdot67}{5\frac{4}{9}} + 1\cdot9\dot{2}85714\dot{1} = \frac{21}{8900} \times \frac{267 \times 9}{4900} + 1\cdot9\frac{2}{7}$

$= \frac{3}{100} \times \frac{3 \times 9}{700} + 1\frac{13}{14} = \frac{3 \times 27}{70000} \times \frac{14}{27} = \frac{6}{10000} = \cdot0006$ *Ans.*

(8) The prices of a duck, a goose, and a fowl are as 1, $1\frac{1}{2}$, and $\frac{3}{4}$, or as 4, 6, 3;
$\therefore$ the proportional amt. for 4 geese and 3 ducks $= 24 + 12 = 36$,
and that for 3 geese and 9 fowls $= 18 + 27 = 45$.
$36 : 45 :: 42s. : 52s.\ 6d.$ *Ans.*

(9) 12) $6\cdot75d.$
$45\cdot5625s.$ is the product of a certain no. of shillings by the same no. of yds.; $\therefore$ $\sqrt{45\cdot5625} = 6\cdot75s. = 6s.\ 9d.$ *Ans.*

(10) Circuit of walls $= (18+15) \times 2 = 66$ ft.; surface to be covered $= 66$ sq. ft. $\times\ 13\frac{1}{2} = 2\frac{1}{4}$ sq. ft. $\times$ no. of yards in length of paper; $\therefore$ length of paper in yds. calculated at $3\frac{1}{4}d.$ a yard $= \frac{3\frac{1}{4}d. \times 22 \times 13\frac{1}{2}}{2\frac{1}{4}} = \frac{13d. \times 11 \times 27}{9} = 13d. \times 33 = 35s.\ 9d.$ *Ans.*

(11) Extent of 1st : that of 2nd :: $1116\frac{1}{4}s. : 5346\frac{1}{4}s.$,
or as 4465 : 21385, or as 893 : 4277, or as 19 : 91;
Value of 1st : that of 2nd :: $658\frac{2}{3}$ po. : 2366 po.,
or as 1976 : 7098, or as 76 : 273;
$\therefore$ the values per acre are as $\frac{76}{19} : \frac{273}{91}$, or as 4 : 3 *Ans.*

(12) *A* advances his price 24*s.* for 6 months, which is at the rate of 16*s.* for 4 months; so that *A*'s credit price at 4 months would be £9 12*s.*+16*s.*=£10 8*s.*

£10 8*s.* : £15 18*s.* 6*d.* :: £9 12*s.*,
or 32 : 49 :: 192*s.* : 6*s.*×49=£14 14*s.* *Ans.*

(13) If *A* be said to do the work in 5 periods, *B* could do it in 7 such periods.

Also, if *A* be said to do 1 measure of work in 1 period, the whole work will be=5 such measures, and *B* will do $\frac{5}{7}$ of a measure in 1 period; and *A* and *B* together will do $1\frac{5}{7}$ measure in 1 period, or the whole work in $5 \div 1\frac{5}{7} = 2\frac{11}{12}$ periods, which by the question is=$8\frac{1}{6}$ da.; or 35 periods=98 da., or 5 periods =14 days. *Ans.*

(14) 5 times the 1st = 9 times the 2nd, or 2nd=$\frac{5}{9}$ of 1st;
9 times the 2nd=12 times the 3rd, or 3rd =$\frac{3}{4}$ of 2nd;
∴ the three fields are as 1, $\frac{5}{9}$, and $\frac{3}{4}$ of $\frac{5}{9}$; or as 36, 20, and 15; sum, 71.

$\frac{1420}{71}$, or 20 ac., ×36, 20, and 15=720 ac., 400 ac., 300 ac. *Ans.*

(15) At the end of the 2 days, there are provisions to last 250 men for 12 days, or 1 man for 3000 days, or 360 men for $8\frac{1}{3}$ days. At the end of 1 day more, there are provisions to last 360 men for $7\frac{1}{2}$ days, or 1 man for 2640 days, or 330 men for 8 days. Hence, the whole of the provisions will have been consumed in 2+1+8=11 days. *Ans.*

(16) (i) Int. on 100=$3\frac{1}{2}\times 3=10\frac{1}{2}$; ∴ 100 is the present worth of $110\frac{1}{2}$, or 200 is that of 221; hence, $\frac{200}{221}$ of £4384$\frac{7}{80}$

$$=\frac{350727\times 200}{80\times 221}=\frac{20631\times 5}{2\times 13}=\frac{1587\times 5}{2}=£3967\ 10s.\ \textit{Ans.}$$

(ii) Here we are to find what principal will in 3 yrs. amount to £4384·0875 at $8\frac{1}{2}$ p. c. compound interest.

Now the required principal × $\left(\frac{103\frac{1}{2}}{100}\right)^3$ would amount to £4384·0875; ∴ we divide that amount by $(\frac{207}{200})$ or by $\frac{8\cdot 869743}{8}$ to obtain the principal.

£4384·0875
8
8·869743) 35072·7000
£3954·1957=£3954 3*s.* 11*d.* *Ans.*

(17) $30s. \times 7 = 210s.$ less than I should have received;
$240s.$ gained;
In all, $450s.$ should have been gained at a profit of $6s.$ a head; $\therefore 450s. \div 6s. = 75$ sheep bought. *Ans.*

(18) Income per £ of investment in $3\frac{1}{2}$ per cents. $= £\frac{3\frac{1}{2}}{85}$;
Income per £ of investment in $4\frac{1}{2}$ per cents. $= \frac{4\frac{1}{2}}{108}$;
Income per £ of investment in both stocks $= \frac{4\frac{1}{8}}{100}$;
hence, $\frac{33}{800} - \frac{7}{170}$ of the 1st $= \frac{1}{24} - \frac{33}{800}$ of the 2nd; or $\frac{1}{17}$ of the 1st $= \frac{1}{3}$ of the 2nd; or the 2nd $= \frac{3}{17}$ of the 1st; or the 2nd is $\frac{14}{17}$ less than the 1st. Hence, £1400 $= \frac{14}{17}$ of the 1st; or the 1st investment $=$ £1400 $\div \frac{14}{17} =$ £100 $\times 17 =$ £1700, and therefore the 2nd $=$ £300 *Ans.*

Paper VI.

(1) $\frac{25s.\ 10{\cdot}8d.}{37s.\ 9{\cdot}25d.}$ of 20 cwt. $= \frac{20 \text{ cwt.} \times 310{\cdot}8}{453{\cdot}25} = \frac{621600}{45325} = \frac{24864}{1813}$
$= \frac{672}{49} = \frac{96}{7} = 13$ cwt. 2 qrs. 24 lbs. *Ans.*

(2) (i) £4570 15*s.* at £5 14*s.* $10\frac{1}{2}d.$

	22853	15		
$10s. = \frac{1}{2}$ of £1	2285	7	6	
$4s. = \frac{1}{5}$ of £1	914	3	0	
$10d. = \frac{1}{12}$ of $10s.$	190	8	$11\frac{1}{2}$	
$\frac{1}{2}d. = \frac{1}{20}$ of $10d.$	9	10	$5\frac{2}{5}$	

Ans. £26253 4*s.* $10\frac{7}{8}d.$

(ii) 8 qrs. 7 bu. $3\frac{1}{2}$ pks. at £2 16*s.* $7d. \times 7$

	10	16	1	
	22	12	8	
7 bu. $= \frac{1}{8}$ of 7 qrs.	2	9	$6\frac{1}{2}$	
$3\frac{1}{2}$ pks. $= \frac{1}{8}$ of 7 bu.	0	6	$2\frac{17}{64}$	
	£225	8	$4\frac{25}{64}$	*Ans.*

(3) $21s. \times {\cdot}3484 : 20s. \times 150{\cdot}08 :: \frac{4 \times {\cdot}39}{5}$ ells.
$: \frac{4 \times 39}{5} \times \frac{20 \times 15008}{21 \times 3484} = \frac{4 \times 4 \times 2144}{268} = \frac{8576}{67} = 128$ ells.

(4) Here we are to have 1728 cub. in.$=(9\times\frac{7}{8})$ cub. in. $\times$ the length of plank in inches; therefore the length of plank in feet will be$=1728\div(9\times\frac{7}{8}\times12)=1728\times\frac{1}{9}\times\frac{8}{7}\times\frac{1}{12}=16\times\frac{8}{7}$ $=18\frac{2}{7}$ ft. *Ans.*

(5) $\dfrac{3\times\sqrt{(3-\frac{1}{9})}+\sqrt{(16-\frac{1}{4})}}{2\times\sqrt{(3+\frac{1}{5})}\times\sqrt{(1+\frac{1}{9})}}=3\sqrt{\frac{14}{5}}\div(\sqrt{\frac{63}{4}}\times2\sqrt{\frac{16}{5}}\times\sqrt{\frac{9}{8}})$.

Multiplying both terms by $\sqrt{7}$

gives $3\,\dfrac{7\sqrt{2}}{\sqrt{5}}\div\left(\dfrac{21}{2}\times\dfrac{8}{\sqrt{5}}\times\dfrac{3}{2\sqrt{2}}\right)$.

Now multiplying both terms by $\sqrt{5}\times\sqrt{2}$

gives $42\div(\frac{21}{2}\times8\times\frac{3}{2})=\frac{1}{3}$ *Ans.*

(6) He gained $£\dfrac{313{\cdot}27}{11{\cdot}53}-£\dfrac{313{\cdot}27}{11{\cdot}68}=\dfrac{11{\cdot}68-11{\cdot}53}{11{\cdot}68\times11{\cdot}53}$ of £313·27.

$£\dfrac{31327\times15}{1168\times1153}=£\dfrac{469905}{1346704}=6s.\ 11\frac{3}{4}d.$ nearly. *Ans.*

(7) The inquiry here is—If 63 light coins contain 2 more than would be supposed from the weight, how many light coins would contain 6 more?

2 : 6 :: 63 coins : 189 coins. *Ans.*

(8) If the spout be said to supply 1 measure per minute, the whole contents of the cistern$=80$ such measures, and when the leak and spout run together the cistern is filled in $102\frac{6}{7}$ min., or $\dfrac{80}{102\frac{6}{7}}=\frac{7}{9}$ of a measure is gained per minute; therefore $1-\frac{7}{9}$ or $\frac{2}{9}$ of a measure is discharged by the leak per minute; hence,

$\frac{2}{9}$ meas. : $\frac{5}{6}$ of 80 meas. :: 1 min. : 300 min.$=5$ hrs. *Ans.*

(9) $\sqrt{5\times5\times5}:\sqrt{8\times8\times8}=5\sqrt{5}:8\sqrt{8}$

$=5\sqrt{5}:16\sqrt{2}=25:16\sqrt{10}=1:{\cdot}64\sqrt{10}$

$=1:3{\cdot}162278\times{\cdot}64=1:2{\cdot}023858$ nearly; sum, 3·023858;

$\therefore\ £488{\cdot}983\div3{\cdot}023858=£488983333\div3023858$

$=£161\ 14s.\ 2d.$, the worth of one; and the remainder of the given joint value is$=£327\ 5s.\ 6d.$, the worth of the other.

Ans.

(10) The man's force added to that of the tide $= 7\frac{3}{4}$ mi.
his force diminished by that of the tide $= 3\frac{1}{4}$
$\therefore$ twice the man's force $= 11$ mi.
or his force of rowing in still water $= 5\frac{1}{2}$ mi. *Ans.*

(11) Suppose him to earn 21*s.* in 10 mths., then he spends 5*s.* in 3 mths. Now 21*s.* in 10 mths.$=\frac{21}{10}$*s.* per month earned; 5*s.* in 3 mths.$=\frac{5}{3}$*s.* per month spent; his income is to his savings as $\frac{21}{10} : \frac{21}{10} - \frac{5}{3}$, or as $\frac{63}{30} : \frac{13}{30}$; that is, he saves $\frac{13}{63}$ of his income. *Ans.*

(12) $\frac{3}{8}$ of the cost of 3 lbs.$=\frac{9}{8}$ of that of 1 lb.; $\frac{5}{12}$ of the cost of $3\frac{3}{8}$ lbs.$=\frac{9}{8}$ of that of 1 lb.; $\therefore \frac{12}{8}$ of the price of the inferior $=\frac{9}{8}$ of that of the finer, or the price of the inferior$=\frac{9}{12}$ or $\frac{3}{4}$ of that of the finer; $\therefore$ 10*d.* is $\frac{1}{4}$ of the price of the finer; hence, the prices are $10d. \times 4 = 3s. 4d.$ and $\frac{3}{4}$ of $3s. 4d. = 2s. 6d.$ *Ans.*

(13) The difference between selling for $105\frac{3}{4}$ of the selling price and selling for $99\frac{7}{8}$ of it$=5\frac{7}{8}$ of it$=\frac{1}{2}d.$

$$5\tfrac{7}{8} : 105\tfrac{3}{4} :: \tfrac{1}{2}d.,$$
$$\text{or } 47 : 423 :: 1d. : 9d. \text{ } \textit{Ans.}$$

(14) Constant difference of the ages$=31-11=20$; and when A's age was to B's as 2 : 7, the difference was$=\frac{5}{2}$ of A's; therefore, when $\frac{5}{2}$ of A's$=20$, A's age was$=20+\frac{5}{2}=8$, which is 3 years ago. *Ans.*

(15) If L be said to do 1 measure per minute, the whole work is $=225$ such measures; hence, M does $\frac{225}{150}$ or $\frac{3}{2}$ of a measure per minute, and N does $\frac{225}{187\frac{1}{2}}$ or $\frac{450}{375}$ or $\frac{6}{5}$ of a measure per minute. Now in the half hour before M began M could have done $\frac{3}{2} \times 30 = 45$ measures; and in the $52\frac{1}{2}$ min. before N began N could have done $\frac{6}{5} \times 52\frac{1}{2} = 63$ measures; and therefore, if M and N had worked from the beginning of L's time, there would have been done $225+45+63=333$ measures at the rate of $1+\frac{3}{2}+\frac{6}{5}$ or $\frac{37}{10}$ measures per minute; $\therefore 333 \div \frac{37}{10} = 9 \times 10 = 90$ min. or $1\frac{1}{2}$ hour. *Ans.*

(16)
$$\begin{array}{rl} 65 \text{ at } 6 \text{ p. c.} & = 390 \\ 37 \text{ ,, } 7\frac{1}{2} & = 277\frac{1}{2} \\ \hline & 667\frac{1}{2} \\ 102 \text{ ,, } 6\frac{1}{2} & = 663 \\ \hline & 4\frac{1}{2} \end{array}$$

for 100 prime cost we have $4\frac{1}{2}$ less.

$4\frac{1}{2} : 100 :: 3s. : 66s.\ 8d.$ *Ans.*

(17)
$$\begin{array}{rl} 128 \text{ at } 109 & = 13952 \\ 4 \text{ ,, } 112 & = \ 448 \\ \hline & 14400 \end{array}$$

$132 \times 110 \times$ the present worth of 1 for the required term $= 14400$; $\therefore$ that pres. worth $= \frac{14400}{132 \times 110} = \frac{100}{100\frac{5}{6}}$ or 100 is the present worth of $100\frac{5}{6}$, or $\frac{5}{6}$ the discount $\div 5 = \frac{1}{6}$ of a year $= 2$ mths. *Ans.*

(18) Using the letters O. G. to denote the original grass. Here we have given — That the O. G. together with 26 days' growth of 1 acre would maintain 66 oxen for $\frac{26}{29\frac{1}{4}}$ days, or 1 ox for $66 \times \frac{8}{9} = 58\frac{2}{3}$ days; and that the O. G. together with 40 days' growth of 1 acre would maintain 34 oxen for $\frac{40}{34}$ days, or 1 ox for $34 \times 2 = 68$ days.

Hence, for each acre the O. G. $+26$ days' growth is to the O. G. $+40$ days' growth as $58\frac{2}{3} : 68$, or as $44 : 51$, or $1 : 1\frac{7}{44}$, where we have an excess of 14 days' growth $= \frac{7}{44}$ of (the O. G. $+26$ days' growth), or 88 days' growth $=$ the O. G. $+26$ days' growth, or the O. G. $= 88 - 26$ or 62 days' growth.

The question now is—If $62 + 26$ days' growth of 1 ac. maintain 1 ox for $58\frac{2}{3}$ days, how many oxen would $62 + 15\frac{1}{2}$ days' growth of 15 ac. maintain for $15\frac{1}{2}$ days?

$$\left.\begin{array}{l} 88 : 77\frac{1}{2} \\ 1 : 15 \\ 15\frac{1}{2} : 58\frac{2}{3} \end{array}\right\} :: 1 \text{ ox} : 50 \text{ oxen.} \textit{ Ans.}$$

PAPER VII.

(1) £267 + £3 17*s.* $10\frac{1}{2}$*d.* = 267 × 20 × 8 + 623 = 3 × 160 + 7
= $68\frac{4}{7}$ oz. or 68 oz. $11\frac{3}{7}$ dwt. *Ans.*

(2) 7 chains = 22 yds. × 7 = 154 yds.; hence, 7 mi. 6 fur. 7 chains $8\frac{1}{4}$ yds. = 62 × 40 × $5\frac{1}{2}$ yds. + 154 yds. + $8\frac{1}{4}$ yds., which + $5\frac{1}{2}$ yds. (= 1 rod) gives 62 × 40 + 28 + $1\frac{1}{2}$ yds. = $2509\frac{1}{2}$ rods. *Ans.*

(3) The no. of sq. yds. in the court-yard = 2475*d.* + 44*d.* = 225 + 4;
∴ the side of the square = $\sqrt{225} + \sqrt{4} = 15 + 2 = 7\frac{1}{2}$ yds. *Ans.*

(4) $\cdot 10605 + \cdot 0254\frac{270}{999} = 1060\frac{1}{2} + 254\frac{10}{27} = \frac{2121}{2} \times \frac{27}{6666} = \frac{21}{2} \times \frac{27}{66} = \frac{567}{136}$
Ans.

(5) The whole length of the pasture = $\frac{12}{12}$ of its length = $\frac{1}{4} + \frac{1}{3}$ + $\frac{5}{12}$ of it;
∴ $\frac{5}{12}$ of the whole length = 10 ft., and the length = 10 ft. + $\frac{5}{12}$ = 24 ft. *Ans.*

(6) $\left.\begin{array}{l} 28 : 63 \text{ m.} \\ 81 : 85 \text{ da.} \\ £20 : £6 \\ 4\frac{1}{2} : 4 \text{ p. c.} \end{array}\right\}$ :: $13\frac{1}{2}$ da. : $\frac{54 \text{ da.} \times 63 \times 85 \times 6}{28 \times 81 \times 90} = \frac{6 \times 17}{4 \times 3}$
= $8\frac{1}{2}$*d.* *Ans.*

(7) 2 horses = 3 mules; ∴ 6 horses = 9 mules; and 6 horses with 5 mules = 14 mules; hence,

190 cwt. : 257 cwt. 3 qrs. 12 lbs. :: 14 mules,
or 190 × 112 lbs. : 28880 lbs. :: 14 mules,
or 8 lbs. : 152 lbs. :: 1 mu. : 19 mu. = 7 + 12 mu.;
and as 3 mules = 2 horses, ∴ 12 mules = 8 horses. *Ans.*

(8) 42 women × $\frac{3}{4}$ = $31\frac{1}{2}$ men; and 52 women × $\frac{3}{4}$ = 39 men;
also 50 boys × $\frac{1}{4}$ = 25 men; and 60 boys × $\frac{1}{2}$ = 30 men;
∴ 28 men 42 women 50 boys = 28 + $31\frac{1}{2}$ + 25 = $84\frac{1}{2}$ men;
22 men 52 women 60 boys = 22 + 39 + 30 = 91 men;
hence, we may state as follows:—

$\left.\begin{array}{l} 84\frac{1}{2} : 91 \text{ m.} \\ 7 : 10 \text{ da.} \end{array}\right\}$ :: 104*s.* : $\frac{104s. \times 91 \times 10 \times 2}{169 \times 7} = 8s. \times 20 = £8$
Ans.

(9) Amount of £1 for 6 half years at $2\frac{1}{2}$ p. c. per half year $=\left(\frac{102\frac{1}{2}}{100}\right)^6=\left(\frac{41}{40}\right)^6=\frac{4750\cdot104241}{4096}=1\cdot1596934$

$$\frac{1596934\times347\frac{3}{4}}{1391}$$

$$4)\ 222\cdot13352$$

$55\cdot53338=$£55 10*s.* 8*d.* *Ans.*

(10)

90	for 50 da.	=	4500	for 1 da.	
150	„ 70	„ =	10500	„	„
110	„ 80	„ =	8800	„	„
350			) 23800		
			68 da.		*Ans.*

(11) *A*'s gross income $=\frac{2090}{86\frac{1}{4}}$ cents at £3 $=\frac{£2090\times12}{345}=\frac{£418}{23}$;

B's gross income $=\frac{3080}{100\frac{5}{8}}$ cents at £$3\frac{1}{8}$ $=\frac{£3080\times28}{805}=\frac{£616\times4}{23}$;

Diff. of nett income $=\frac{4}{23}$ of $(£616-£418)\times\frac{230}{240}=£198\times\frac{1}{6}$
$=£33$ *Ans.*

(12) Int. on 100 $=\frac{5}{12}$ of $4\frac{1}{2}=1\frac{7}{8}$; ∴ the principal that would amount to £14022·45 is $=\frac{100}{101\frac{7}{8}}$, or $\frac{100}{163}$ of £14022·45, which is invested in the 3 per cents. at 78, making $\frac{14022\cdot45\times160}{163\times78}$ cents, which being sold out at $81\frac{1}{2}$ to buy 4 p. c. stock at 108 would produce $\frac{14022\cdot45\times160\times81\cdot5}{163\times78\times108}$ cents at £4 $=\frac{£4\times1402245\times10}{32\times2700}$
$=\frac{£4\times1078650}{8100}=\frac{£4\times119850}{900}=$£532 13*s.* 4*d.* *Ans.*

(13) *C*'s share of 1st joint capital $=1-\cdot24-\cdot32=\cdot44=\frac{11}{25}$; ∴ $\frac{11}{25}$ of 1st joint capital $=\frac{11}{29}$ of 2nd, or the 1st joint capital : the 2nd :: 25 : 29; but the 2nd joint capital was £420 − £100 = £320 more than the 1st, and was also $\frac{4}{25}$ more than the 1st; ∴ $\frac{4}{25}$ of the 1st = £320, or the 1st joint capital = £320 ÷ $\frac{4}{25}$ = £2000; which is to be divided into 3 parts as ·24 : ·32 and ·44, or as 6, 8, 11; sum, 25; ∴ $\frac{£2000}{25}$ or £80, × 6, 8, 11, gives to *A* £480, to *B* £640, to *C* £880 *Ans.*

(14) Amt. of 1 by simple int. for 3 yrs. at $4\frac{1}{2}$ p. c. $=1+\frac{4\frac{1}{2}\times 3}{100}$ $=1{\cdot}135$, which is to be = the 3rd power of the amt. of 1 for 1 year by compound interest; $\therefore \sqrt[3]{1{\cdot}135}=1{\cdot}043114$, the amount of 1 by compound interest for 1 year, showing the required rate to be 4·3114 p. c. *Ans.*

(15) Here we are first to find in what proportions spirits worth 21*s.* and 36*s.* must be mixed to have an average worth of 27*s.*, and these proportions are 36 − 27 and 27 − 21, or 9 and 6, or 3 and 2; but the two quantities must make up 25 gallons; hence, $\frac{3}{5}$ and $\frac{2}{5}$ of 25 gallons = 15 gall. and 10 gall. *Ans.*

(16) $\frac{20s.\times 100}{21}=95\frac{5}{21}$ dozen at prime cost for £100; and the grocer would have to sell $95\frac{5}{21}-8$ or $87\frac{5}{21}$ dozen for the prime cost of $95\frac{5}{21}$ dozen, viz. for £100; hence,

$87\frac{5}{21}$ doz. : $\frac{229}{12}$ doz. :: £1000
or $1832\times 4 : 229\times 7$ :: £100;
or 32 : 7 :: £100 : £21 17*s.* 6*d.* *Ans.*

(17) If A be said to do 1 measure of work in 1 hour, the whole work is = 6 such measures, so that B does $\frac{6}{5}$, and $C\,\frac{6}{4\frac{1}{2}}$, or $\frac{4}{3}$, of a measure per hour. Now if B and C had continued to the end of A's time, the amount of work done would have been $=6$ meas. $+\frac{6}{5}$ meas. $\times 2\frac{1}{2}+\frac{4}{3}$ meas. $\times 1\frac{1}{2}=6+2\frac{2}{5}+2=10\frac{2}{5}$ meas. by A, B, C, in A's time at the rate of $1+\frac{6}{5}+\frac{4}{3}=\frac{8}{15}$ meas. per hour; hence, $10\frac{2}{5}$ meas. $\div 3\frac{6}{15}$ meas. $=53\times 3\div 53=3$ hours. *Ans.*

(18) For the indirect course we have, by the Chain Rule,

? *pence* = 1 *ruble*
when 1 *ruble* = 1·56 *flor.*
69·68 *flor.* = 100 *mks.*
40 *mks.* = 35 *flor.*
48 *flor.* = 100 *francs*
25·55 *francs* = 240 *pence*

$$\frac{240d.\times 3500\times 156}{25{\cdot}55\times 48\times 40\times 69{\cdot}68}=\frac{25\times 3}{{\cdot}73\times 2{\cdot}68}=\frac{750000}{19564}$$
$=38{\cdot}33572d.$ per *ruble*;

hence, as the direct course gives only 38*d.*, the merchant in London would find the indirect course better by $\cdot 33572d.\times 8000 = £11\ 3s.\ 9\frac{3}{4}d.$ *Ans.*

PAPER VIII.

(1) $144\left\{\begin{array}{l}12)\ 98437112 \text{ sq. in.}\\ 12)\ 8203092\ \ldots 8\\ 9)\ 683591 \text{ ft. } 8 \text{ in.}\\ 75954 \text{ yds. } 5 \text{ ft.}\end{array}\right.$ $\quad 30\frac{1}{4}$ $\quad 121\left\{\begin{array}{l}11)\ 303816\\ 11)\ 27619\ \ldots 7\\ 40)\ 2510 \text{ po. } 106 \text{ qr. yds.}\\ 4)\ 62 \text{ ro. } 30 \text{ po. } 26\frac{1}{2} \text{ yds.}\end{array}\right.$ $\quad \begin{array}{|l} 75954 \text{ sq. yds. } 5 \text{ ft. } 8 \text{ in.}\\ \hline 4\\ \hline \end{array}$

	ac.	ro.	po.	yds.	ft.	in.
	15	2	30	26	4	72
					5	8
	15	2	30	27	0	80

Ans.

(2) $\sqrt{1{\cdot}980777} \div \sqrt{{\cdot}0173} = \sqrt{\frac{19807{\cdot}77}{173}} = \sqrt{114{\cdot}49} = 10{\cdot}7$ *Ans.*

(3) £158 13*s.* 7½*d.* at 9*s.* 10½*d.* per £.

5*s.* = ¼ of £1	39	13	$4\frac{7}{8}$
4*s.* = ⅕ of £1	31	14	$8\frac{7}{10}$
10*d.* = ½ of 5*s.*	6	12	$2\frac{13}{16}$
½*d.* = $\frac{1}{20}$ of 10*d.*	0	6	$7\frac{109}{320}$
Ans.	£78	6	$11\frac{233}{320}$

Otherwise:—Since $9\frac{7}{8}s. = 10s. - \frac{1}{8}s.$

£158 13*s.* 7½*d.*

10

	1586	16	3
$1\frac{1}{2}d. = \frac{1}{8}s.$	19	16	$8\frac{7}{16}$
20	1566	19	$6\frac{9}{16}$
Ans.	£78	6	$11\frac{233}{320}$

(4) The incomes per £ of investments are £ $\frac{3}{87\frac{1}{8}}$ and £ $\frac{3\frac{1}{2}}{101\frac{5}{8}}$, which are as $\frac{21}{609\frac{7}{8}}$ and $\frac{21}{609\frac{3}{4}}$; hence, as the latter fraction has the less denominator, the 3½ per cents. is the preferable stock. *Ans.*

(5) Int. on 100 for 245 days $=\frac{245}{365}$ of $3\frac{1}{7}=\frac{154}{73}=2\frac{8}{73}$, or $102\frac{8}{73}$ is the amount of 100; hence,

$102\frac{8}{73}$: 100 :: £1297 6*s.* 1·58*d.*
7454 : 7300 :: 311353·58*d.*
or 1 : 7300 :: 41·77*d.* : 4177*d.*$\times$73
$=$£1270 10*s.* 1*d.* *Ans.*

(6) 240*d.* − 9*d.* : 240*d.* − 7*d.* :: £404 5*s.*
or 231*d.* : 233*d.* :: 8085*s.*
or 1*d.* : 233*d.* :: 35*s.* : £407 15*s.* *Ans.*

(7) $\frac{3\frac{2}{3}}{17\frac{1}{2}}$ of ·32000 / 279·5 of £29 11*s.* 6*d.* / £119 15*s.* of 63 qrs. 1 bu. 1 pk. / 110 qrs. 1 pk. of 374 *guin.*

$=21s.\times374\times\frac{2021\text{ bu.}}{3521\text{ bu.}}\times\frac{1183}{7990s.}\times\frac{320\frac{1}{11}}{279500}\times\frac{11\times2}{35\times3}$

$=21s.\times374\times\frac{2021}{1}\times\frac{13}{7990}\times\frac{1}{21500}\times\frac{2}{15}$

$=\frac{21s.\times22\times2021\times13\times2}{470\times21500\times15}=\frac{7s.\times22\times26}{10\times500\times5}=\frac{28s.\times22\times26}{100000}$

$=$·16016*s.* *Ans.*

(8) In every fraction $=\frac{5}{9}$, the numerator is to the denominator as 5 : 9, so that the difference of the terms will be $=\frac{4}{9}$ of the denominator; hence, if $\frac{4}{9}$ of the denominator $=68$, the denominator $=68\div\frac{4}{9}=17\times9=153$; hence, $\frac{5}{9}=\frac{85}{153}$ *Ans.*

(9) Call the hour hand H and the minute hand M. At 6 o'clock H is 30 minute spaces or $\frac{1}{2}$ an entire revolution in advance of M, and we have therefore to find in what time M will gain $\frac{1}{2}$ a revolution on H, it being known that M gains on H 55 minute spaces or $\frac{11}{12}$ of a revolution per hour.

$\frac{11}{12}$ rev. : $\frac{1}{2}$ rev. :: 60 min. : $32\frac{8}{11}$ min. past 6 *Ans.*

(10) *B*, if he walked $\frac{7}{5}$ of $\frac{5}{7}$ of *A*'s no. of hrs. a day for $\frac{3}{2}$ of $\frac{2}{3}$ of *A*'s no. of days, would complete a journey $\frac{7}{5}$ of $\frac{3}{2}$ of $\frac{5}{8}$ as long; that is, *B*, if he walked *A*'s no. of hrs. a day for *A*'s no. of days, would complete a journey $\frac{21}{16}$ as long; hence, *A*'s rate is to *B*'s as 16 : 21 *Ans.*

(11) Prime cost of the 1st kind $=\frac{100}{111\frac{1}{4}}$ of 7*s.* 5*d.*

Prime cost of the 2nd kind $=\frac{100}{109\frac{1}{2}}$ of 6*s.* 1*d.*

$89d.\times\frac{400}{445}:\frac{300}{219}=\frac{400}{5}:\frac{300}{3}=6:5$ *Ans.*

(12) $\left.\begin{matrix} 3\frac{1}{2} : 4\frac{1}{2} \\ 100 : 1675 \end{matrix}\right\} :: £94\frac{1}{2} : \frac{£189\times9\times1675}{7\times200} = \frac{£27\times9\times67}{8}$

$= £2035\ 2s.\ 6d.$ *Ans.*

(13) $\left.\begin{matrix} 93\frac{1}{2} : 44 \\ 8 : 15 \\ 9 : 10 \end{matrix}\right\} :: 8s.\ 6d. : \frac{17s.\times44\times150}{187\times8\times9} = \frac{150}{18} = 8s.\ 4d.$ *Ans.*

(14) B takes 30+21 minutes to walk the distance that A rides in 21 minutes; therefore A's rate is to B's as 51 : 21; and hence, 51 : 21 :: $8\frac{1}{2}$ mi. : $3\frac{1}{2}$ mi. an hour. *Ans.*

(15) Circuit of walls = (21 ft. 7 in. + 18 ft. 11 in.) × 2 = 81 ft., and the surface to be covered = $\frac{4}{5}$ of 81 sq. ft. × $13\frac{1}{3}$ = 27 sq. ft. × 32, which is also = $2\frac{3}{5}$ sq. ft. × the no. of feet length of paper; ∴ the length of paper required = $27\times32\div2\frac{3}{5}$ feet = $9\times160\div13$ yds., which is equal to $\frac{9\times160}{13\times12}$ pieces = $9\frac{9}{13}$ pieces; and ∴ $9\frac{1}{2}$ pieces must be bought, or $\frac{1}{2}-\frac{3}{13}=\frac{7}{26}$ of 12 yds. more than requisite; hence, $\frac{7}{26}$ of 10*s.* 10*d.* = 2*s.* 11*d.* *Ans.*

(16) From 100 at first invested the proceeds are 90; then from an investment of this 90 the proceeds are $\frac{88}{100}$ of 90 = 72·2; lastly, from an investment of 72·2 the proceeds are 100, or there is a gain of 20·8 on 79·2; hence,

$$79\cdot2 : 100 :: 20\cdot8,$$
$$\text{or } 99 : 100 :: 26 : 26\tfrac{26}{99}\text{ p. c.}$$ *Ans.*

(17) The incomes per £ invested were $£\frac{3}{79\frac{1}{4}}$ or $£\frac{12}{319}$ from the 1st investment, and $£\frac{3\frac{1}{4}}{88}$ or $£\frac{13}{352}$ from the 2nd, and both together were equal to $£\frac{206}{5524}$ or $£\frac{103}{2762}$ for each £ in the whole sum invested; hence, $\frac{12}{319}$ of the 1st investment + $\frac{13}{352}$ of the 2nd = $\frac{103}{2762}$ of both.

500304 of the 1st + 520637 of the 2nd = 525712 of both;

or $\frac{33144-32857}{319\times2762}$ of 1st = $\frac{36256-35906}{2762\times352}$ of 2nd;

or 2nd = $\frac{287}{319\times2762}\times\frac{2762\times352}{350}$ of 1st = $\frac{287}{319}$ of $\frac{352}{350}=\frac{41}{29}$ of $\frac{16}{25}$ of 1st;

or 1st : 2nd :: $29\times25 : 41\times16$, or as 725 : 656;

∴ $\frac{725}{1381}$ and $\frac{656}{1381}$ of £5524 = £2900 and £2624 *Ans.*

(18) Using the letters O. G. to denote the original grass. We have given here—That the O. G. together with 10 days' growth would maintain 90 oxen for 10 days, or 1 ox for 900 days; and that the O. G. together with 36 days' growth would maintain 35 oxen for 36 days, or 1 ox for 1260 days. Hence, the O. G.+10 days' growth is to the O. G.+36 days' growth as 900 is to 1260, or 5 : 7, or as 1 : $1\frac{2}{5}$, where we have an excess of 26 days' growth $=\frac{2}{5}$ of (the O. G.+10 days' growth), or 65 days' growth = the O. G.+10 days' growth; or the O. G.=55 days' growth. The inquiry now is—If 55+10 days' growth maintain 90 oxen for 10 days, how many days' growth would maintain 24 oxen for 1 day?

$$\left.\begin{matrix} 90 : 24 \\ 10 : 1 \end{matrix}\right\} :: 65 \text{ days' growth} : 1\tfrac{11}{15} \text{ days' growth};$$

from which it appears that in 1 day 24 oxen consume $1\frac{11}{15}-1$ or $\frac{11}{15}$ day's growth of the O. G., so that they would consume the whole of the grass in $55\div\frac{11}{15}=5\times15=75$ days. *Ans.*

PAPER IX.

(1) $123\frac{171}{623}$ qrs. $\times 934\frac{1}{2}\div 5760=\frac{76800}{623}\times\frac{1869}{11520}=\frac{960\times3}{144}=20$ lbs. *Ans.*

(2) £3 17*s.* $10\frac{1}{2}d.\div$ £4 4*s.* $11\frac{5}{11}d.=\frac{1869}{2}\times\frac{11}{11214}=\frac{11}{12}$ *Ans.*

(3) $7\frac{1}{2}-5=2\frac{1}{2}$ hrs. gained per day; $\therefore 2\frac{1}{2}$ hrs. $\times 365\frac{1}{4}\times35$ gained in 35 years; and these hours reduced to years by dividing by 24 and $365\frac{1}{4}$ become $=\frac{5\times35}{2\times24}$ yrs. $=3\frac{31}{48}$ yrs.

$=3$ yrs. $+\frac{31}{48}$ of 365 da. 6 hrs.

$$48\left\{\begin{array}{r|l} & 31 \\ \hline 4) & 11322 \quad 18 \\ \hline 12) & 2830 \quad 16 \quad 30 \text{ min.} \end{array}\right.$$

Ans. 3 yrs. 235 da. 21 hrs. $22\frac{1}{2}$ min.

(4) (i) 383 at 1 cwt. 2 qrs. 15 lbs.

		cwt.	qrs.	lbs.
		383	0	0
2 qrs. $=\frac{1}{2}$ of	1 cwt.	191	2	0
14 lbs. $=\frac{1}{4}$ of	2 qrs.	47	3	14
1 lb. $=\frac{1}{14}$ of	14 lbs.	3	1	19
	Ans.	625	3	5

(ii)

$10s.\ 0d. = \frac{1}{2}$ of £1	625·795 at £1 12*s.* $8\frac{1}{2}d.$
$2\ \ 6 = \frac{1}{4}$ of 10*s.*	312·8975
$2\frac{1}{2} = \frac{1}{12}$ of 2*s.* 6*d.*	78·224875
	6·518739$\frac{7}{12}$

£1023·436114$\frac{7}{12}$

20

8·7222912$\frac{2}{3}$*s.*

12

Ans. £1023 8*s.* 8·667500*d.*

(5) $\frac{100}{103\cdot5}$ of £$\frac{20059\cdot48}{4\cdot8} = \frac{25074350}{1035\times6} = \frac{2507435}{207\times3}$ = £4037 14*s.* $9\frac{1}{207}d.$ *Ans.*

(6) ? *florins* = £1 when £1 = 25·545 *francs*; 262 *francs* = 100 *florins*

$\frac{100\ fl.\times25\cdot545}{262} = 9\cdot75\ flor.$ *Ans.*

(7) Int. on £283 1*s.* $5\frac{7}{9}d.$ for 5 mths. = $\frac{5}{3}$ of £3 10*s.* $9\frac{2}{9}d.$

= 5 17 $11\frac{10}{27}$

£288 10 $5\frac{4}{27}$: £5 17*s.* $11\frac{10}{27}$ = 49 : 1;

49 : 1 :: £325 10*s.* 7*d.* :: £6 12*s.* $10\frac{2}{7}d.$ *Ans.*

(8) From 2 o'clock to 45 min. past 8 = $6\frac{3}{4}$ hrs.

12 hrs. : $2\frac{1}{2}$ min. :: $6\frac{3}{4}$ hrs. : $1\frac{13}{32}$ min. gained in the $6\frac{3}{4}$ hrs.;

∴ $1\frac{13}{32}$ min. before 2 = $58\frac{19}{32}$ min. past 1. *Ans.*

(9) 1 cwt. at 31*s.* 3*d.* with 6 p. c. profit = $31\frac{1}{4}\times\frac{106}{100} = 33\frac{1}{8}s.$

$\frac{224}{392} = \frac{4}{7}$ cwt. at 33*s.* 9*d.* = $19\frac{2}{7}$

$\frac{105}{392} = \frac{15}{56}$ „ „ 32*s.* 2*d.* = $8\frac{69}{112}$ $\qquad 27\frac{101}{112}$

$\frac{63}{392} = \frac{9}{56}$ „ „ $(5\frac{25}{112}s. + \frac{9}{56})$ $\qquad = 5\frac{25}{112}s.$

$\frac{585}{112}s.\times\frac{56}{9} = \frac{585}{18} = \frac{65}{2} = 32s.\ 6d.$ *Ans.*

(10) The square on the diagonal is = twice the square on a side;

∴ $\frac{1}{2}$ of $2740\frac{3}{4}\times2740\frac{3}{4}$ = the square feet in the area; hence, the square root of this = $2740\frac{3}{4}\times\sqrt{\frac{1}{2}} = 2740\cdot75\times\frac{1}{2}\sqrt{2}$

$= 2740\cdot75\times\cdot7071 = 1938$ ft. nearly. *Ans.*

(11) When *A* sets out *B* is $3\frac{7}{8}$ mi. $\times1\frac{1}{2} = \frac{93}{16}$ mi. before him, which *A* gains at the rate of $6\frac{3}{8} - 3\frac{7}{8}$ or $\frac{217}{72}$ mi. per hour;

∴ $\frac{93}{16} \div \frac{217}{72} = \frac{3}{2} \div \frac{7}{9} = \frac{27}{14}$ hrs. = 1 hr. $55\frac{5}{7}$ min. *Ans.*

Secondly, when *C* sets out he and *B* are to travel between them, in opposite directions, $22 - \frac{93}{16}$ mi. with the united speed of $5\frac{3}{8} + 3\frac{7}{8}$ or $9\frac{1}{4}$ mi. an hour; therefore they will meet in $\frac{259}{16}$ mi. $\div \frac{37}{4}$ mi. = $\frac{259}{148}$ hrs. = $\frac{7}{4} = 1\frac{3}{4}$ hrs. *Ans.*

(12) If the edge of a cube = 1, the square on the diagonal of each of the faces is 1+1=2, and this together with the square on the edge is = 3 = the square on the diagonal of the cube, so that the diagonal of a cube is = the length of the edge × $\sqrt{3}$; hence, first, $\sqrt[3]{2{\cdot}197} \times \sqrt{3} = 1{\cdot}3 \times 1{\cdot}732 = 2{\cdot}2516$, or $2\frac{1}{4}$ in. nearly. *Ans.*

Secondly, $2{\cdot}2795 \div \sqrt{3}$ = the length of the edge, and the cube of this $= 2{\cdot}2795^3 \div 3\sqrt{3} = 11{\cdot}844556 \div 5{\cdot}196 = 2{\cdot}2795$ cub. ft. *Ans.*

(13) If A be said to supply 1 measure per minute, the whole content of the cistern is = 51 such measures; also, C discharges $\frac{51}{76}$ of a measure per minute.

Now the actual times of running are as follows:

		16
$8\frac{1}{2}$	$8\frac{1}{2}$	$13\frac{3}{5}$
$13\frac{3}{5}$	16	36
$22\frac{1}{10}$ min. by A,	$24\frac{1}{2}$ min. by B,	$65\frac{2}{5}$ by C.

A, therefore, supplies $22\frac{1}{10}$ meas., and C discharges $65\frac{2}{5} \times \frac{51}{76} = 44\frac{2}{95}$ meas.; therefore B supplies $44\frac{2}{95} - 22\frac{1}{10} = 21\frac{35}{38}$ meas. in $24\frac{1}{2}$ min.

$21\frac{35}{38}$ meas. : 51 meas. :: $24\frac{1}{2}$ min.;
or 833 : 969 :: 49 min. : $\frac{969}{17} = 57$ min. *Ans.*

(14) A's age is now $\frac{7}{16}$ less than B's, and was formerly $\frac{5}{9}$ less than B's, as the difference of A's and B's ages is constant; ∴ B's present age is to his former age as $\frac{5}{9} : \frac{7}{16}$, or as 80 : 63, showing a difference $= \frac{17}{80}$ of B's present age $= 8\frac{1}{2}$; ∴ B's age $= 8\frac{1}{2} \div \frac{17}{80} = 40$, and A's $= \frac{9}{16}$ of $40 = 22\frac{1}{2}$ *Ans.*

(15) $44\frac{2}{5} \times 26 \times 25\frac{1}{4} : 90 \times 71 \times 35$
$99 : 80\frac{4}{5}$ } :: 13 min. : $81\frac{5}{11}$ min.

Now, if the leak be said to discharge 1 measure per minute, the whole content of the 2nd cistern is $= 537\frac{3}{5}$ such measures; also, the 2nd pipe supplies $537\frac{3}{5} \div 81\frac{5}{11} = 6\frac{3}{5}$ measures per minute;

∴ $6\frac{3}{5} - 1 = 5\frac{3}{5}$ meas. gained per minute, or the whole $537\frac{3}{5}$ meas. in $537\frac{3}{5} \div 5\frac{3}{5} = 2688 \div 28 = 96$ minutes. *Ans.*

(16) If for the weight of the 3rd bar we put 1 quantity, then for the 2nd we have $1\frac{1}{2}$ such quantity, and for the 1st 1 such quantity + 151·225 oz.; sum, $1+1\frac{1}{2}+1$ quantity + 151·225 oz.; that is, the whole weight of the 3 bars is = 151·225 oz. more than $3\frac{1}{2}$ times the weight of the 3rd.

$$\cdot 06 \text{ p. c.} = \frac{6}{10000} = \begin{array}{r} 575 \text{ oz.} \\ 0{\cdot}345 \text{ oz.} \end{array}$$

weight of the 3 bars = 574·655 oz.

weight of the 3rd $= (574{\cdot}655 - 151{\cdot}225) \div 3\frac{1}{2} = 120{\cdot}98$ oz.;

$\therefore$ the weight of the 1st = 272·205 oz.; and the three bars weigh 272·205, $120{\cdot}98 \times 1\frac{1}{2}$, and 120·98, which are as 4·5, $2 \times 1\frac{1}{2}$, and 2, or as 9, 6, 4 *Ans.*

(17) At 5 o'clock H, the hour hand, is 25 minute spaces in advance of M, the minute hand; and to find at what time H will be 12 spaces before M or gain 13 spaces on M, the rate of M's gain on H being 55 minute spaces per hour, we state:

55 spaces : 13 spaces :: 60 min. : $14\frac{2}{11}$ min. past 5, the time indicated by the 2nd watch.

Now 1 hour being = 3600 seconds, and the 1st watch gaining $4\frac{1}{2}$ seconds, and the 2nd 3 seconds per hour, we have $3604\frac{1}{2} : 3603 :: 5$ hrs. $14\frac{2}{11}$ min. $- 2$ hrs., or 2403 : 2402 :: $194\frac{2}{11}$ min. : 19216 min. $\div 99 = 194\frac{10}{99}$ min. = 3 hrs. $14\frac{10}{99}$ min., showing that the time indicated by the 1st watch is $14\frac{10}{99}$ min. past 5; $\therefore$ 60 min. : $14\frac{10}{99}$ min. :: 55 min. spaces : $12\frac{25}{27}$ min. spaces, the interval between the hands of the 1st watch. *Ans.*

Also, $3604\frac{1}{2} : 3600 :: 3$ hrs. $14\frac{2}{11}$ min. : 3 hrs. $13\frac{21}{33}$ min., showing the right time to be $13\frac{21}{33}$ min. past 5 *Ans.*

(18) Let O. G. stand for original growth. Here we have given—That the O. G. together with 8 days' growth would maintain 19 oxen for 8 days, or 1 ox for 152 days; also, that the O. G. together with 10 days' growth could maintain 16 oxen for 10 days, or 1 ox for 160 days. Hence, the O. G. + 8 days' growth is to the O. G. + 10 days' growth as 152 to 160, or as 19 to 20, or as $1 : 1\frac{1}{19}$, where we have an excess of 2 days' growth = $\frac{1}{19}$ of (the O. G. + 8 days' growth), or 19×2 days' growth = the O.G. + 8 days' growth; hence, the O.G. = 30 days' growth. Now 1 ox in 152 days eats 30 + 8 days' growth; $\therefore$ 1 ox in 1 day eats $\frac{38}{152}$ or $\frac{1}{4}$ of a day's growth; $\therefore$ the

20 oxen in 3 days eat $\frac{1}{4}\times 60$ or 15 days' growth, leaving $45-15$ or 30 days' growth to be eaten in 15 days, which will require 8 oxen;

for $\left.\begin{matrix}15 & : & 1\text{ da.}\\ \frac{1}{4} & : & 30\end{matrix}\right\}$ :: 1 ox : 8 oxen; ∴ the required no. of oxen is $20+8=28$ oxen. *Ans.*

Paper X.

(1) 40 lbs. : 24 lbs. :: $1869\times\frac{20}{21}$ *guin.* : 1068 *guin.* *Ans.*

(2) £1532 10*s.* 3*d.* : £1 :: $18206\frac{1}{4}$ *flor.* : $\frac{72825\times 20}{122601}$
$=11{\cdot}88$ *flor.* nearly. *Ans.*

(3) $2s.\ 6d.\times 2+2s.\times 3+1s.\times 3=14s.$
$14s.\times 2530\times 10\frac{1}{2}\times 140=£14\times 2530\times 10\frac{1}{2}\times 7=£2603370$
Ans.

(4) $\cdot 95184^2=\cdot 906$, sum of the four squares;
$\cdot 4^2+\cdot 6^2+\cdot 04^2=\cdot 5216$
$\sqrt{\cdot 3844}=\cdot 62$ *Ans.*

(5) $\sqrt[3]{521660\frac{1}{8}}=\frac{1}{2}\sqrt[3]{4173281}=80\frac{1}{2}=\frac{7}{8}$ of the square root referred to; $80\frac{1}{2}\times\frac{8}{7}=92$=the square root referred to; $92^2-4=8460$, the product referred to; $(8460\div 5)\times 8+464=14000$ *Ans.*

(6) (i) $39{\cdot}371$ in. $\times 56{\cdot}7$: 36 in. :: $\frac{75d.}{8}\times 264{\cdot}57$
$\therefore \frac{75d.\times 26457\times 3600}{8\times 567\times 39371}=\frac{22097500}{551194}=40{\cdot}09d.=3s.\ 4d.$ *Ans.*

(ii) Ten million mètres = 393710000 in. = one quarter of the earth's circumference.
$\frac{393710000\times 4}{36\times 1760}=\frac{39371000}{1584}=24855$ mi. *Ans.*

(7) $\frac{15\frac{2}{3}-4\frac{5}{6}}{3\frac{1}{9}+2\frac{1}{11}}$ of 1 acre $+\frac{7}{11}$ of $\frac{£2\frac{1}{7}-\frac{3}{8}\text{ of }4s.\ 6d.}{\frac{3}{7}\text{ of }3s.\ 3\frac{3}{4}d.+2s.\ 10\frac{1}{2}d.}$ of 3 ro. 12 po.
$=\frac{265}{24}\times\frac{99}{515}$ ac. $+\frac{7}{11}$ of $\frac{£15-2\frac{5}{6}\text{ of }54d.}{9s.\ 11d.+34\frac{1}{2}d.\times 7}$ of $\frac{33}{40}$ ac.
$=\frac{53}{8}\times\frac{33}{103}$ ac. $+\frac{7}{11}$ of $\frac{3458\frac{1}{4}d.}{360\frac{1}{2}d.}$ of $\frac{33}{40}$ ac.
$=\frac{1749}{824}$ ac. $+\frac{13833\times 3}{8240}$ ac. $=\frac{58989}{8240}$ ac. $=7$ ac. $25\frac{48}{103}$ po. *Ans.*

(8) Given 339 dwt. standard gold worth £66, and 20 lbs. standard silver worth £66.

339 dwt. gold : 1274 dwt. gold :: 20 lbs. silver
: 75 lbs. 1 oz. 19 dwt. silver nearly. *Ans.*

(9) $\left.\begin{matrix} £278{\cdot}9095 & : & £150{\cdot}9229\frac{1}{6} \\ 2\frac{1}{3} & : & 2\frac{1}{2} \end{matrix}\right\} :: £3530{\cdot}5$

$$\frac{£35305\times 905537{\cdot}5\times 5}{2789095\times 14\times 2}=\frac{25\times 163{\cdot}75}{2}=£2046{\cdot}875$$

$=2046$ *sovs.* 8 *flor.* 7 *cents* 5 *mils. Ans.*

(10) By $\frac{5}{8}$ premium is meant $£\frac{5}{8}$ premium.

Amount of each share $=£\frac{5}{6}\times\frac{100}{5}=£\frac{50}{3}$;

$£\frac{50}{3}+£\frac{5}{8}$: $£\frac{5}{6}$,

or 415 : 20 :: 100 : $4\frac{28}{83}$ p. c. *Ans.*

(11)

£2564			at 5 p. c.	=£128 4*s.*
3658	6*s.*	8*d.*	„ 12 „	= 439
6222	6	8		£567 4
567	4	0		
4) 5655	2	8	nett proceeds	
1413	15	8		
4241	7	0	*A*'s $\frac{3}{4}$ of nett proceeds	
3219	6	8	given by *A* for the debts	
1022	0	4	owing from *B* to *A*. *Ans.*	

(12) $\frac{1050}{100}=10\frac{1}{2}$ cents at $£3\frac{1}{2}=£36\frac{3}{4}$ the 1st income; $10\frac{1}{2}$ cents sold out produce $£95\times 10\frac{1}{2}$; 8 p. c. per annum for $1\frac{1}{4}$ yrs.=10 p. c.

$\frac{95\times 10\frac{1}{2}\times 110}{100}=£1097\frac{1}{4}$ the amount invested in 3 p. c.; and obtaining $36\frac{3}{4}+6=£42\frac{3}{4}$ income; $42\frac{3}{4}$: 3 :: $1097\frac{1}{4}$: 77 *Ans.*

(13) In the time in which they row 15 miles with the tide they could row $\frac{1}{2}(15+7)=11$ miles in still water; and $11\div 5\frac{1}{4}$ $=2\frac{2}{21}$ hrs., $\therefore (15-11)\div 2\frac{2}{21}=84\div 44=1\frac{10}{11}$ miles an hour.

Ans.

(14) 5) £1350000

270000 borrowed at 5 p. c.

1080000 held in shares

Receipts in one year		£100000
38 p. c. for working charges	= £38000	
8 p. c. reserved	= 8000	46000
		£54000
Int. on £270000 at 5 p. c.		= 13500
Amount of dividends		£40500

1080000 : 100 :: 40500 : $3\frac{3}{4}$ p. c. *Ans.*

(15) Here $3\frac{1}{2}$ times the 1st part together with $6\frac{1}{2}$ times the 2nd $=5\frac{1}{4}$ times both; $5\frac{1}{4}-3\frac{1}{2}$ times the 1st$=6\frac{1}{2}-5\frac{1}{4}$ times the 2nd; or the 1st : the 2nd :: $1\frac{1}{4}$: $1\frac{3}{4}$, or as 5 : 7; sum, 12; hence, the parts are $\frac{5}{12}$ and $\frac{7}{12}$ of £600 = £250 and £350 *Ans.*

(16) $\sqrt{1{\cdot}524^3}=1{\cdot}524\times\sqrt{1{\cdot}524}=1{\cdot}524\times1{\cdot}2345=1{\cdot}881$,

which $\times 365\frac{1}{4}=687$ days. *Ans.*

(17) Here the inquiry is—How much gold $\times\frac{36\frac{1}{2}}{240}$ together with 63 oz. $\times\frac{25}{240}$ is equal to the sum of both quantities $\times\frac{13\frac{1}{3}}{100}$;

$\therefore \frac{73}{480}$ of 1st $+\frac{50}{480}$ of 2nd $=\frac{64}{480}$ of both; or 73 − 64 times the 1st = 64 − 50 times the 2nd; or the 1st : the 2nd :: 14 : 9; but the given quantity of the 2nd = 63 oz.;

$\therefore$ 9 : 14 :: 63 oz. : 98 oz. = 8 lbs. 2 oz. *Ans.*

(18) The joint amount of the quantities per invoice and per order would evidently be equal quantities of brandy and rum for £15 19*s.* + £14 17*s.*, or £30 16*s.*; therefore 616*s.* ÷ (78*s.* + 34*s.*) $=5\frac{1}{2}$ dozen, the whole quantity ordered, and 297*s.* ÷ $5\frac{1}{2}$ = 54*s.*, the average price per dozen; accordingly, we have 78 times the quantity of brandy together with 34 times that of rum = to 54 times both; and therefore 78 − 54 times the quantity of brandy = 54 − 34 times that of rum; or the quantities of brandy and rum ordered are as 20 : 24, or 5 : 6; sum, 11. Hence, $\frac{5}{11}$ and $\frac{6}{11}$ of $5\frac{1}{2}=2\frac{1}{2}$ dozen brandy, and 3 dozen of rum. *Ans.*

Paper XI.

$30\frac{1}{4}$ 4 — 10889 sq. in. 8 ft. 124 in. 4

(1) $144\left\{\begin{array}{l}12)\,14113420\text{ sq. in.}\\ 12)\,1176118\,..\,4\\ \hline 9)\,98009\text{ ft. }124\text{ in.}\\ \hline 10889\text{ yds. }8\text{ ft.}\end{array}\right.$ $121\left\{\begin{array}{l}11)\,43556\\ 11)\,3959\,..\,7\\ \hline 40)\,359\text{ po. }117\text{ sq. yds.}\\ \hline 8\text{ ro. }39\text{ po. }29\frac{1}{4}\text{ yds.}\end{array}\right.$

ac.	po.	yds.	ft.	in.
2	30	29	2	36
			8	124
2	39	30	2	16 *Ans.*

(2) 480 grs. $\times$ 2170 $\div$ 7000 grs. $= 48 \times 31 \div 10 = 148\frac{4}{5}$ lbs. *Ans.*

(3) 7 mi. 6 fur. 120 yds. at £4 15*s.* 6*d.* 7

	£	*s.*	*d.*
	33	8	6
4 fur. $=\frac{1}{2}$ of 1 mi.	2	7	9
2 $=\frac{1}{4}$ of 4 fur.	1	3	$10\frac{1}{2}$
110 yds. $=\frac{1}{2}$ of 2 „	0	5	$11\frac{2}{8}$
10 $=\frac{1}{11}$ of 110 yds.	0	0	$6\frac{45}{88}$
Ans.	£37	6	$7\frac{7}{11}$

Otherwise.

	£4 15*s.* 6*d.* $\times$ 6
	28 13 0
6 fur. $=\frac{1}{8}$ of 6 mi.	3 11 $7\frac{1}{2}$
120 yds. $=\frac{1}{11}$ of 6 fur.	0 6 $6\frac{3}{22}$
	£37 6 $7\frac{7}{11}$ *Ans.*

(4) Int. on £3246 in $3\frac{1}{2}$ yrs. $=$ £400
do. 1 „ 1 yr. $= 400 \div (£3246 \times 3\frac{1}{2})$
do. 100 „ 1 „ $= 40000 \div (1623 \times 7)$
$= 3{\cdot}5208$ p. c. nearly. *Ans.*

(5) Int. on $100 = 3\frac{1}{2} \times 3\frac{1}{2} = 12\frac{1}{4}$; $\therefore$ $112\frac{1}{4}$ is the amt. of 100;
$\frac{100}{112\frac{1}{4}}$ or $\frac{400}{449}$ of £3592 $=$ £400 $\times 8 =$ £3200 *Ans.*

(6) Selling price per oz. in the 1st instance $= 154d. \div 2{\cdot}53 = 1400d. \div 23$; and to find what price per oz. would gain $6\frac{1}{2}$ per cent.

$$105 : 106\tfrac{1}{2} :: \frac{1400d.}{23} : \frac{700d. \times 213}{23 \times 105} \text{ per oz.};$$

$$\therefore 17s.\ 9d. \div \frac{700d. \times 213}{23 \times 105} = \frac{213d. \times 23 \times 3}{20d. \times 213} = 3{\cdot}45 \text{ oz. } \textit{Ans.}$$

(7) $\frac{\frac{3}{5} \text{ of } (\frac{7}{8} - \frac{1}{9}) - \frac{5}{54}}{\frac{7}{8} - \frac{5}{7} \text{ of } (\frac{5}{6} - \frac{4}{5})}$ of a cub. yard. $= \frac{\frac{11}{24} - \frac{5}{54}}{\frac{7}{8} - \frac{1}{35}}$ cub. yds.

$$= \frac{79}{216} \div \frac{237}{8 \times 35} = \frac{79}{27} \times \frac{35}{237} = \frac{35}{81} \text{ cub. yds.} = \frac{35 \times 27 \times 1728}{81} \text{ c. in.}$$

$$= 35 \times 576 \text{ cub. in.}$$

Also, 2 cub. ft. 234 in. $= 3456 + 234 = 3690$ cub. in.

$$\frac{3690 \text{ in.}}{35 \times 576 \text{ in.}} = \frac{410}{35 \times 64} = \frac{41}{7 \times 32} = \frac{41}{224} \textit{ Ans.}$$

(8) Int. on $£97\frac{1}{2}$ in 12 months $= £3\ 10s.$

do. 195 „ „ $= 7\ 0$

do. 1 „ 1 month $= 7 \div (195 \times 12)$

do. 156 „ 18 months $= \frac{£7 \times 156 \times 18}{195 \times 12} = \frac{£7 \times 12 \times 3}{15 \times 2}$

$$= £7 \times 6 \div 5 = £8\ 8s. \textit{ Ans.}$$

(9) Premium paid to cover $£97\frac{3}{4} = £2\frac{1}{4}$

do. do. $1 = \frac{9}{391}$

do. do. $805 = \frac{£9 \times 805}{391} = \frac{£9 \times 35}{17}$

$$= £18\ 10s.\ 7\tfrac{1}{17}d. \textit{ Ans.}$$

(10) $\dot{8}5636 = \frac{85636}{99999} = \frac{271 \times 316}{271 \times 369} = \frac{316}{369}$ *Ans.*

$\dot{8}56\dot{3}685 = \frac{1}{1000}$ of $856\frac{335}{909} = \frac{778439}{909000}$ *Ans.*

(11) $\frac{40882d.}{7} \times \frac{1{\cdot}7278}{7} = \frac{70635{\cdot}9196d.}{7 \times 7} = 1441{\cdot}54937\frac{47}{49}d.$

$$= £6\ 0s.\ 1{\cdot}54937\tfrac{47}{49}d. \textit{ Ans.}$$

(12) There is here required the comp. int. on £4000 for 8 half years at 2 per cent. per half year.

$(\frac{102}{100})^8 = 1{\cdot}02^8 = 1{\cdot}17165938 =$ amt. of 1;

Int. $= {\cdot}17165938 \times 4000 = £686{\cdot}6375$ nearly

$$= £686\ 12s.\ 9d. \textit{ Ans.}$$

(13) Int. on 100=$\frac{1}{4}$ of $4\frac{1}{2}$=$1\frac{1}{8}$; therefore the mercantile cash value of 100=$98\frac{7}{8}$; accordingly, $\frac{92\frac{3}{4}}{100}$ of the required stock will be =$\frac{98\frac{7}{8}}{100}$ of £583 13*s.* 3*d.*, or the stock is=$\frac{791}{742}$ or $\frac{113}{106}$ of £583 13*s.* 3*d.*=£622 4*s.* $1\frac{1}{2}$*d.* *Ans.*

(14) £675 8 *flor.* 4 *cents*=£675·84;
income from investment of·69·30 *francs*=3 *francs*;
∴ do. do. £69·30=£3;
$\frac{675{\cdot}84}{69{\cdot}30}$ at £3=£$\frac{6144}{210}$=£204 16*s.*÷7=£29 5*s.* $1\frac{5}{7}$*d.* *Ans.*

(15)
$\frac{22}{24}$ or $\frac{11}{12}$ of 19·25=17·$6458\frac{1}{3}$
$\frac{2}{24}$ or $\frac{1}{12}$ of 8·9 = 0·$7416\frac{2}{3}$
18·3875 *Ans.*

(16)
1 gal. at 15*s.*=15*s.*
4 „ „ 13 =52
5)67

The first two quantities cost $13\frac{2}{5}$*s.* average per gallon.
Average prime cost of the mixture=$\frac{100}{133\frac{1}{3}}$, or $\frac{3}{4}$ of 18*s.* 8*d.* =14*s.* Now the proportions at $13\frac{2}{3}$*s.* and 19*s.* to produce an average of 14*s.* will be as 19*s.*−14*s.* and 14*s.*−$13\frac{2}{3}$*s.*, or as 5 and $\frac{2}{3}$, or as 25 and 3; but there are 6 gallons at 19*s.*; ∴ 3 : 25 :: 6 gall. : 50 gall.=sum of 1st and 2nd quantities that are as 1 : 4; ∴ $\frac{1}{5}$ and $\frac{4}{5}$ of 50=10 gallons and 40 gallons. *Ans.*

(17) Given 3 m.=7 b., or 1 m.=$\frac{7}{3}$ b.; ∴ 14 m.=$32\frac{2}{3}$ b., and 6 m. =14 b.=13 w.; ∴ 1 w.=$\frac{14}{13}$ b., and 12 w.=$\frac{168}{13}$ b., and 4 w. =$\frac{56}{13}$ b.=9 g.; ∴ 1 g.=$\frac{56}{117}$ b., or 5 g.=$\frac{280}{117}$ b.; ∴ 12 w.+5 g. =$\frac{168}{13}+\frac{280}{117}$ b.=$\frac{1792}{117}$ b. The question, therefore, is—If $32\frac{2}{3}$ +10 boys take 3 days, each $9\frac{5}{12}$ hrs., how many boys along with $\frac{1792}{117}$ boys would take 8 days, each $7\frac{4}{5}$ hrs.?

$7\frac{4}{5}\times 8 : 9\frac{5}{12}\times 3 :: 42\frac{2}{3}$ boys : $\frac{128 \text{ boys}\times 113\times 5}{12\times 8\times 39}=\frac{4\times 113\times 5}{3\times 39}$
=$\frac{2260}{117}$ boys; hence, $\frac{2260}{117}-\frac{1792}{117}=\frac{468}{117}$=4 boys. *Ans.*

(18) A cubic foot of gold weighs $\frac{1000}{16}$ Avoird. lbs. $\times 18\frac{3}{8}$; $\frac{1000}{16} \times \frac{7000}{5760} \times 12 \times 20 = \frac{7000000}{16 \times 24}$ dwt., which $\times 18\frac{3}{8}$ gives $\frac{7000000 \times 147}{16 \times 24 \times 8}$ dwt. Also, 100 *sovereigns* weigh $\frac{113 \text{ dwt.}}{22} \times 100$; $\frac{7000000 \times 147}{16 \times 24 \times 8} : \frac{11300}{22} :: 1728$ cubic inches : $1728 \times \frac{113}{11} \times \frac{16 \times 24 \times 4}{70000 \times 147}$ cub. inches worth £100 $= 1728 \times \frac{64 \times 8}{49 \times 7 \times 1000} \times \frac{113}{110}$, the cube root of which is $= 12 \times \frac{8}{70} \times \sqrt[3]{1 \cdot 0272727}$ $= \frac{96}{70}$ of 1·009009 = 1·38378 in. *Ans.*

PAPER XII.

(1)

ac.	ro.	po.	yds.	ft.	in.
2	0	39	30	2	$16 \times 5\frac{1}{2}$
					11
2) 24	2	39	$29\frac{1}{2}$	5	32
12	1	19	29	10	70

= 12 ac. 1 ro. 19 po. 30 yds. 1 ft. 70 in. *Ans.*

(2) $450 \cdot 4465 \div 1 \cdot 234 = 450446\frac{1}{2} \div 1234 = 365\frac{36\frac{1}{2}}{1234}$; ∴ 1·234 could be subtracted 365 times, and the value of the remainder would be $\frac{36\frac{1}{2}}{1234}$ of $1 \cdot 234 = \frac{36\frac{1}{2}}{1000} = \cdot 0365$ *Ans.*

(3) £1 12*s.* $7\frac{1}{2}$*d.* = £1·63125;
£43 9 *flor.* 7 *cts.* = £43·97;
$\frac{163 \cdot 125}{4397} = \cdot 0371$ nearly. *Ans.*

(4) £1056 12*s.* 8*d.* at $13\frac{3}{4}$ p. c.

$12\frac{1}{2} = \frac{1}{8}$ of 100	132	1	7
$1\frac{1}{4} = \frac{1}{10}$ of $12\frac{1}{2}$	13	4	1·9
	£145	5	8·9 *Ans.*

(5) 2*s.* 9*d.* $\times 10 = 27$*s.* 6*d.* a ton, showing a gain of 2*s.* on 25*s.* 6*d.*
25*s.* 6*d.* : 2*s.* :: 100 : $7\frac{43}{51}$ p. c. *Ans.*

(6) Since A can do $\frac{1}{7\frac{1}{2}}$, and B $\frac{1}{8\frac{1}{4}}$ of the work per hour, their remuneration should be as $8\frac{1}{4} : 7\frac{1}{2}$, or as 33 : 30, or as 11 : 10; sum, 21;

Therefore A should get $\frac{11}{21}$ of 10*s.* 6*d.*=5*s.* 6*d.*
and B „ „ $\frac{10}{21}$ of 10*s.* 6*d.*=5*s.* } *Ans.*

(7) Their gains are respectively $\frac{115{\cdot}2}{1120}$, $\frac{110{\cdot}7}{1230}$, and $\frac{102{\cdot}6}{1260}$ of their stocks, or as $\frac{18}{175}$, $\frac{9}{100}$, and $\frac{57}{700}$;

$\frac{18}{175} : \frac{9}{100}$ :: 12 mths. : $10\frac{1}{2}$ mths. B's time
$\frac{18}{175} : \frac{57}{700}$ :: 12 mths. : $9\frac{1}{2}$ mths. C's time } *Ans.*

(8) 120 : 3 :: 3135 : $78\frac{3}{8}$ *Ans.*

(9) The interests on £1 are $\frac{3\frac{1}{2}}{82\frac{1}{2}}$ and $\frac{4\frac{1}{2}}{105}$, which are as $\frac{7}{165} : \frac{3}{70}$, or as $\frac{7}{33} : \frac{3}{14}$, or as 98 : 99 *Ans.*

(10) Time for £$83\frac{1}{4}$ to yield £3 =1 year;

do. 1 „ „ 1 $=\frac{1}{3}$ yr. $\times 83\frac{1}{4}$;

do. $346\frac{7}{8}$ „ „ $31\frac{1}{4}=\frac{1}{3}$ yr. $\times 83\frac{1}{4} \times \frac{31\frac{1}{4}}{346\frac{7}{8}}$

$$=\frac{333\times125}{2775\times2\times3} \text{ yrs.}=\frac{111\times25}{555\times2}=\frac{25}{10}=2\tfrac{1}{2} \text{ yrs. } \textit{Ans.}$$

(11) Int. on 3*s.* $7\frac{1}{2}d.$ in $3{\cdot}9\frac{6}{11}$ yrs.=$2\frac{1}{2}d.\times\frac{1}{10}$ of $39\frac{6}{11}=\frac{1}{4}$ of $39\frac{6}{11}d.$ $=9\frac{39}{44}d.$; ∴ amt. of 3*s.* $7\frac{1}{2}d.$=4*s.* $5\frac{17}{44}d.$, or amt. of 1914=2349; hence, $\frac{1914}{2349}$ of £63 9*s.*=$\frac{22}{27}$ of £63 9*s.*=£51 14*s.* *Ans.*

(12) $$\frac{4 \text{ ac. } 2 \text{ ro. } 39 \text{ po.}}{7{\cdot}48 \text{ ac.}}\times\frac{1{\cdot}19}{3\sqrt{2}}\times\frac{15\sqrt{2{\cdot}5}}{4}\times\frac{\sqrt{(6\frac{1}{2}\times5\frac{1}{2}-4\frac{1}{2})}}{6\frac{1}{2}\times5\frac{1}{2}+4\frac{1}{2}}$$

$$=\frac{759}{748\times4\times40}\times\frac{119}{3\sqrt{2}}\times\frac{15\sqrt{5}}{4\sqrt{2}}\times\frac{10\sqrt{5}}{161}$$

$$=\frac{33}{44\times4\times40}\times\frac{7}{24}\times\frac{750}{7}=\frac{75}{4\times16\times8}=\frac{75}{512} \textit{ Ans.}$$

(13) A's int. on £2235 for 2 yrs. =£223 10*s.* 0*d.*
B's „ „ 3210 „ 19 mths.= 254 2 6
C's „ „ 1980 „ 16 „ = 132 0 0

£1400 − £609 12 6 =£790 7*s.* 6*d.*,

of which each partner receives $\frac{1}{3}$=£263 9*s.* 2*d.*

∴ A's total gain=£486 19*s.* 2*d.*
B's „ „ = 517 11 8
C's „ „ = 395 9 2 } *Ans.*

(14) $\frac{1}{3\frac{2}{3}+1\frac{5}{12}}$ of $\sqrt{3\frac{2}{3}-1\frac{5}{12}}=\frac{12}{44+17}$ of $\frac{3}{8}=\frac{12}{61}$; $\frac{12}{61}+\frac{3}{7}$ of $\frac{43}{61}=\frac{255}{427}$ of the sum $=68d.\times 6$; $\therefore \frac{5}{427}$ of the sum $=8d.$; $\therefore$ the sum $=8d.\div\frac{5}{427}=\frac{3416d.}{5}=683\frac{1}{5}d.=£2\ 16s.\ 11\frac{1}{5}d.$ *Ans.*

(15) $12\times 9\times 165 : 240\times 10\frac{1}{2}\times 8\frac{1}{4} :: 37\frac{1}{2}$ tons coal

$$: \frac{75\times 15\times 21\times 33}{12\times 9\times 165}=\frac{25\times 7}{4}=43\tfrac{3}{4} \text{ tons coal}$$

2 tons of iron $=18\frac{3}{4}$ „ „

Ans. 25 „ „

(16)

63 at 1·82 = 114·66
24 „ 1·00 = 24·00
87 − 1 = 86) 138·66
1·612 *Ans.*

(17) $\frac{112\frac{1}{2}}{100}$ of $\frac{£17}{18}=\frac{£17}{16}$ the average selling price per gal.; to find proportions of quantity at $£\frac{15}{14}$ and $£\frac{20}{21}$ making an average of $£\frac{17}{16}$;

$\frac{15}{14}-\frac{17}{16}$ of 1st $=\frac{17}{16}-\frac{20}{21}$ of 2nd; or $\frac{1}{16\times 7}$ of 1st $=\frac{37}{16\times 21}$ of 2nd; or 3 times 1st = 37 times 2nd; or 1st : 2nd :: 37 : 3; but 1st is given 74; $\therefore$ 2nd is 6; and 74+6=80 gallons. *Ans.*

(18) $\frac{2125}{76\frac{1}{2}}$ or $27\frac{7}{9}$ cents at £3 = $£83\frac{1}{2}$, *A*'s 1st income;

$\frac{6760\frac{5}{2}}{88\frac{1}{2}}$ or $76\frac{7}{18}$ cents at $£3\frac{1}{2}=£267\frac{13}{36}$, *B*'s 1st income

B's original stock $= 76\frac{7}{18}$ cents,

of which *A* bought $\frac{27\frac{7}{9}\times 78\frac{3}{4}}{90} = 24\frac{11}{36}$

Rem. of *B*'s stock $= 52\frac{1}{12}$ cents.

A's 2nd income, $24\frac{11}{36}$ at $£3\frac{1}{2}=£85\frac{5}{72}$

A's 1st income $= 83\frac{1}{3}$

A's increase of income, $£1\frac{53}{72}$

B sold $24\frac{11}{36}$ cents at 90 = $£2187\frac{1}{2}$, cash proceeds,

and $52\frac{1}{12}$ cents at 94 = $4895\frac{5}{6}$ „ „

Whole of *B*'s proceeds, $£7083\frac{1}{3}$, by investing which in the 3 per Cents. he obtained an income of $£267\frac{13}{36}-1\frac{53}{72}=£265\frac{5}{8}$.

hence, $265\frac{5}{8} : 3 :: 7083\frac{1}{3} : 80$ *Ans.*

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